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PREPARATIONS FOR THE UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT ON THE BASIS OF GENERAL ASSEMBLY RESOLUTION 44/228 AND TAKING INTO ACCOUNT OTHER RELEVANT GENERAL ASSEMBLY RESOLUTIONS:

Conservation and Development of Forests

Report by the Secretary-General of the Conference

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1. The Preparatory Committee of the United Nations Conference on Environment and Development (UNCED) at its first session recommended in its Decision 1/14 that discussions on the issue of protection and sustainable management of forest ecosystems must be coordinated and compatible with other actions related to reduction of emissions of greenhouse gases, protection of biological diversity, rational utilization of biological resources and improvement of market conditions for timber and timber products that might be taken by the FAO, ITTO, UNEP and WMO in connection with conventions on climate change and on biological diversity and other relevant agreements.

2. Furthermore, the Preparatory Committee requested the Secretary-General of the United Nations Conference on Environment and Development (UNCED) to prepare for the second session of the Preparatory Committee, with the assistance of the relevant international organizations and in close consultation with Governments, recognizing their sovereignty over their natural resources within their territories, a comprehensive report, to cover various aspects of forest and forestry related technical, economic and social matters, and to suggest to the Preparatory Committee, at its second session, options for the coordination of national, regional and international action on forests.

3. In order to respond to that decision the Secretary-General of UNCED consulted Governments through his note verbale of October 1990 and convened an Ad-Hoc Working Party on Forests to ensure advice and support for the preparation of his report. Following the presentation of his Progress Report on Forests to the Second Session of the Preparatory Committee and taking into account the deliberations on this area and the decision 2/13, the Secretary-General called again upon the Working Party on Forests, consulted governments through a note verbale (June 1991) and drew upon the knowledge of independent experts on their personal capacities to finalize the report being submitted herewith.

4. Substantive contributions for the preparation of the report were received from several United Nations organizations, and among others the Food and Agriculture Organization of the United Nations (FAO), the United Nations Conference on Trade and Development (UNCTAD), the United Nations Development Programme (UNDP), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Environment Programme (UNEP), the United Nations Research Institute for Social Development (UNRISD), and the World Bank. The Secretariat also received valuable support from several intergovernmental organizations and from non-governmental organizations and experts and, in particular, from Friends of the Earth, the International Tropical Timber Organization (ITTO), the International Union for Conservation of Nature and Natural Resources (IUCN), Greenpeace International, the World Resources Institute (WRI), the World Wide Fund for Nature (WWF) and the secretariats of some of the related Conventions such the Convention on Wetlands (Ramsar) and the Convention on International Trade of Endangered Species.

Introduction

5. The concept of forests has evolved from an approach that considered forests as wastelands or just hunting grounds to a more comprehensive view which includes all its physical (soil, water, gases) and biological (plants

and animals) components together with the role it plays for the benefit of society as a producer of goods and services and as a modulator of climate or water cycles.

6. The world forests are subject to a number of natural and anthropogenic pressures. Climate changes, air, water and soil pollution, pests and fires, recreational needs, needs for more farmlands to produce food, fodder or raw materials, needs for timber, fuelwood or other forest goods are only some of the more direct pressures. Indirect pressures derive from the burden of the foreign debt on developing countries, the deleterious effects of some foreign loans and investments, conditions of aid and trade that promote unsustainable exploitation of natural renewable resources, etc. These pressures have resulted in substantial forest loss. Even though this process is not necessarily new as a similar one took place in Europe beginning with the expansion of the Roman Empire the speed and consequences are different. Probably the only new factors are the additional impact of air pollution, the effect of population increase and the much shorter time frame in which the process is developing in the "south" accelerated by the effects of modern machinery, transport and communications, combined with the current institutional structures and land tenure patterns.

7. During the 1980s deforestation and forest degradation and problems related to the marketing of timber products throughout the world gave rise to some important initiatives at the international and regional levels, such as the launching of the Tropical Forestry Action Plan by FAO, UNDP, the World Bank and the World Resources Institute (1985); the entry into force of the International Tropical Timber Agreement (ITTA) and the establishment of the International Tropical Timber Organization (ITTO) in 1985, the launching by the International Union of Forest Research Organizations (IUFRO) of their Special Programme for Developing Countries, the organization of the International Conference on Forests and Trees ("Silva") organized by the French Government (February 1986), and the Ministerial Conference for the Protection of Forests in Europe (Strasbourg, December 1990). Furthermore far-reaching discussions were initiated in the area of forest research starting with the discussions held in the Bellagio meeting on Forest research.

8. At the national and local levels some governments have been induced to take more drastic and sometimes direct measures. Thus, Bolivia has launched a five-year ecological "moratorium" which includes, inter alia, temporarily suspending logging concessions; Brazil has, among other measures, modified its incentive policies for cattle ranching which was one of the important causes of clearing in the Amazonian forest; Guyana has set aside an area of 360,000 ha of tropical forest for conservation and research; Viet Nam has launched a Forestry Development Strategy from 1991 to 2000 and India has launched a conservation oriented forestry policy. New Zealand has established a ban on the export of indigenous forests products unless harvested from a forest with a certified sustained management plan. More recently a new trend towards placing unilateral special restrictions and controls on the use and imports of tropical timber has developed as per example Germany, the United Kingdom and the Netherlands.

9. The present report deals with the status of the world's forests, their role in several elements of social development and environment including for example the conservation of habitats of biodiversity; as sinks of greenhouse gases and as source of energy for rural communities. It also analyses briefly the problems related to the assessment of the economic value of forests, and the effects of trade barriers. It also looks into the role played by women in forest utilization and management. The report constitutes also the basis for the proposals considered in AGENDA 21 (Doc: A/CONF.151/PC/42/Add.3).

SECTION I

STATUS OF FOREST RESOURCES

Historical Evolution of the Concept and Status of Forests

10. The driving forces that have caused changes in the extent and quality of forests historically are largely still at work today, although not always in the same areas. Therefore studies of the changes and their causes are of great value when looking for remedies to unwanted developments in present time.

11. Such studies could monitor the extent and quality of forests in such a way that changes in the capability of forests to fulfil their functions are revealed. The soil protection capacity, the attractiveness for recreation, the capacity to provide habitats for a rich flora and fauna and other services from the forest need to be taken into account. For instance, there has been a significant increase in volumes of growing stock in many European countries in the last 50 years. This is positive for the functions of wood production and carbon sequestering, but how has it affected the recreational function of forests or its original biological diversity, where such functions are important? And what about nature conservation, hunting, protection against landslides and avalanches etc.?

12. Valuable information on this subject is available from many sources, but is usually limited geographically and does not cover entire countries. What follows represents an attempt to retrieve information on historical changes including their causes and consequences from available documentation.

General Observations on Historical Changes

13. Specific historical events related to historical changes in the forest resource can be put in the framework of a general pattern, which has been well described by Mather in his book "Global Forest Resources" (1990): "in many parts of the world a sequential pattern of use of the forest resource can be demonstrated. Initially, the forest is seen as an almost unlimited resource, with little danger of exhaustion and little need of conservation. Trends in forest use and area are perceived in neutral or positive terms: a reduction in forest area may be welcomed in allowing an expansion of the agricultural area. As this phase of resource destruction proceeds, some voices begin to call for conservation. They may eventually lead to legislation or other government action aimed at halting the trends". The strength and effect of these voices has varied. "In some countries forest destruction was halted while significant forest areas still survived. In others it continued to a point where the forest resource was all but exhausted. In some instances,

near-exhaustion was followed by attempts at the re-creation of the resource, and in a few of these cases the expansion of the forest area has recently attracted adverse reaction".

14. In detail this sequential pattern is not quite so simple as the outline may suggest. Nevertheless in general terms it appears to be as valid as it is simple, but different parts of the world have reached different stages in this model.

15. The evolution in the management of the forests could also be compared to that in agriculture or in fisheries. Initially, utilization of the forest resource resembles hunting or gathering more than farming. It involves the direct use of a natural resource with little or no manipulation. Only later is management applied and, in some cases, trees are grown under conditions as artificial as those under which wheat or rice are produced. Again the model is perhaps not simple or linear: there may be deviations and reversals. Nevertheless, the transition from hunting/gathering to farming the forest has been made in many parts of the world, although several stages exist at a given time.

Appraisals by Region

The boreal zone

16. In the boreal zone populations have cleared less than one per cent of the forest area for agriculture. In the most densely populated European parts of the boreal zone grazing of domestic animals has locally opened up forests.

17. Industrial felling of trees have occurred locally in mining areas several hundred years back. They became more common in the late 19th century, when sawmilling became an important export industry. In general the use of the boreal forest for wood production is far below potential. Nevertheless serious over-exploitation of forests occurred in the accessible areas, i.e. close to population centres and harbours, causing disruptions in the sustainability of wood supplies. In some cases clear-felled areas are quickly invaded by pioneer tree species. In general ecological damage is restricted to those cases, where sensitive habitats are affected. Game production is sometimes favoured by the occurrence of young forest.

18. Even though shifting cultivation was still in use in some forest areas in the beginning of the twentieth century in the Nordic countries of Europe they soon introduced active forest management with compulsory regeneration after clear felling. Today they have higher growing stocks and volume growth than ever since the latest ice age. The possibility of earning cash income from wood in conjunction with predominantly private ownership, the introduction of modern agriculture and an active forest policy have been major driving forces behind the build-up of the forest resource.

Europe (USSR excluded)

19. Assuming that three quarters of the whole land area of Europe were once forested it could be ventured that almost 200 million ha or more than 50 per cent of the original forest cover have been cleared. About 160 million ha are still under forest in Europe.

20. In the non-Mediterranean part of Europe, an almost continuous and dense forest once covered most of the land. Deforestation begun with the expansion of the Roman Empire and accelerated later in the seventh century progressing from the south to the north and from the west to the east.

21. Deforestation was characterized by massive clearings for cropping the land, over-exploitation of the forest for fuelwood and timber, over-grazing, and fires. The process was occasionally altered by wars, epidemics, and changing economic circumstances which brought about temporary reversals. But the overall trend continued until at least the last century and to such an extent that there was a wood shortage already in the sixteenth century. This situation worsened as a result of the intensification of agriculture, industrial development and its heavy demands for wood for melting and refining metals, glass-making, pitprops, ship-building, and more recently for railway sleepers.

22. Beginning in the nineteenth century the deforestation process was gradually reversed. Several driving forces behind this can be distinguished:

(i) The increasing productivity of agriculture lead to a release of marginal land. This was reinforced by an exodus of rural people from the marginal agricultural areas to urbanized areas, where the demand for labour from industries and the service sector was rapidly increasing. According to FAO the number of agricultural workers in industrial countries decreased from more than 300 million in 1950 to a little more than 100 million in 1990 and is expected, if the trend is maintained, to be less than 30 million by 2025.

(ii) The forest became a source of regular cash income for forest owners, as sawmilling industry developed in the nineteenth century.

(iii) Awareness grew that deforestation may have adverse ecological consequences.

23. A rough indication of trends in forest cover can be obtained from four sets of figures on the extent of the forest area corresponding to the early 1930s, the late 1940s, the early 1960s, and around 1980. According to those somewhat heterogeneous and not fully complete figures the total forest area of Europe (USSR excluded) has increased by 2 per cent between 1930 and 1960, and by another 19 per cent between 1960 and 1980.

The Mediterranean region

24. In the whole Mediterranean region the forest vegetation has been degraded and destroyed by human activities during more than 10,000 years. It has been reduced to about one sixth of the Mediterranean area and confined to land that cannot readily be cultivated. The vast majority of the area still under forest is covered by stunted thickets ("maquis" and "garrigue") that have been much degraded by overgrazing, fires, over-cutting, charcoal-making and, more recently, by tourism.

Japan

25. Between the early seventeenth and early nineteenth centuries Japanese forestry went from almost unregulated exploitation of forests to an era of rapidly developing plantation forestry. This development was preceded by a dramatic population increase. Furthermore in the beginning of this period the country, which had been ravaged by civil war for over a century, was pacified by a ruling elite whose passion for monumental constructions consumed immense volumes of lumber. The various forms of forest depletion that followed had two direct consequences: landslides and a wood supply crisis. From about the 1660's government policies began to address both problems. At first watershed management policies were developed and land use was regulated, especially along seashores and streams. Afforestation and the maintenance of protection forest became standard practice. Only later, in the eighteenth century afforestation became a major tool for securing wood production as well. By the second half of the nineteenth century advanced forest management was introduced and marketing arrangements were well developed.

United States

26. The evolution of the forest cover and the simultaneous population development from 1,500 to present time can be summarized as follows:

27. Before the arrival of the first European immigrants, an indigenous population estimated at less than one million made limited use of wood for fuel, weapons, and housing but also destroyed large areas of forest each year by setting fires to flush out game. Heavy grazing by buffaloes (and other herbivores) helped keep as grassland many areas that would normally have been covered with trees.

28. Inroads into forestlands began in general with the arrival of the first settlers. Trees were overabundant and free for the taking; forests harboured indigenous communities and wildlife and covered land needed for crops. It is estimated that more than 400 million ha were still under forest in the seventeenth century. Lumber industry became significant during the eighteenth century. The first wave of loggers took out the high value trees for shipmasts and naval timbers. Firewood harvesting and cattle grazing were heavy.

29. In the 1930s, for the first time since the 1600s, the inroads on total forest land came to a halt and the wooded area began to increase slightly. The Depression reduced timber cutting, and the movement of most of the population to the cities allowed some farmland to revert to forest.

30. Some 20 years after, in 1960, the forested area had increased to about 306 million ha, thanks to intensified conservation and sustainable utilization practices. More effective forest-fire fighting, more careful cutting, public awareness campaigns and replanting helped to strike a better balance between annual cut and annual growth. The United States of America imports furthermore an important amount of timber and timber products from other regions of the world.

31. In the last few years, a public outcry to further protect the dwindling "old-growth" and eventually still pristine forests of the United States of America has encouraged a revision of forest national policies.

The Tropics and Sub-Tropics

32. The latest FAO/UNEP Global Forest Resources Assessment has 1980 as the reference date. It assessed the status of the forests and undertook the first systematic estimation of deforestation for the tropical zones. In this assessment the rate of deforestation for the whole tropical world was estimated to be more than 11 million ha per year, while plantations were estimated at only one million hectares per year.

33. Around 1980 the annual percentage of deforestation in the three main tropical regions was of the same order of magnitude (0.5 to 0.7 per cent for closed broadleaved and open broadleaved). However, the situation varied considerably between subregions and countries. A summary is given below.

Closed forests of the humid tropics

Tropical America

34. It is possible to group countries, or parts of countries, in relation to the gravity of the deforestation. There are those such as Guyana and a large part of the Brazilian Amazonia where deforestation is negligible since pressure from agriculture is absent. There are others where the deforestation was negligible, in absolute terms, because the existing forest cover was already reduced to a minimum (El Salvador, Haiti, and Jamaica). In all the other countries deforestation was important and it tended to increase where zones that were previously inaccessible had become available as a result of infrastructure development and colonization programmes (e.g. in Brazil, Colombia, Ecuador, Peru and Bolivia). The clearing of coniferous forests was particularly serious. While mining and oil prospection and exploitation are a pressure in the Upper Amazon region of the Andes, coca production constitutes another pressure for deforestation and pollution.

Tropical Africa

35. Côte d'Ivoire and Nigeria alone, with respectively 310,000 and 285,000 ha deforested annually in the period 1976-80, accounted for almost one half of the total deforestation in tropical Africa. The coastal forest of West Africa was under severe stress and its progressive disappearance was already a fact, while clearing did not threaten the Cameroon-Congolese forest. The situation was very serious in Madagascar and in the Sahelian Africa.

36. The deforestation which has taken place during this century in Côte d'Ivoire is an illustration of what has happened more generally to the tropical moist forest of West Africa.

37. It is estimated that at the beginning of the century, tropical forests covered 15 million hectares of Côte d'Ivoire, i.e. practically the whole southern half of the country. In 1955, date of the first complete aerial photograph coverage, their area had been reduced to 11.8 million ha - 10 years

later a comparison of old and new photographs showed that the same area had been reduced to 9 million ha. It decreased further to 6.2 million ha in 1973 and 4 million in 1980.

Tropical Asia

38. In the years around 1980 the forests that appeared least threatened were those of the Indian states where shifting cultivation was not widespread; Pakistan; parts of Myanmar; Cambodia; and the island of New Guinea (Irian Jaya and Papua New Guinea) where population pressure was relatively low.

39. For Thailand historical estimates of areas under forest indicate that the forest cover has decreased from 75 per cent in 1913 to 53 per cent in 1963 and to around 30 per cent in the 1980s. Population pressure, shifting cultivation, the harvest of forest products for both domestic and international markets, opium production, and the expanding areas in upland crops in response to new export opportunities are all important factors of destruction of the Thai forests.

Deforestation in open tree formations of the dry tropics

40. The estimates for these areas are generally more approximative than those of the closed forest because they are less surveyed than the latter.

41. Of the almost 4 million ha of open tree formations cleared annually in the tropical world from 1976 to 1980, more than one half were cleared in Tropical Africa, particularly in East Sahelian Africa and Tropical Southern Africa. About one third was cleared in Tropical America, with almost 1.3 million ha in Tropical South America. With 0.7 percent of the total area of open tree formations cleared yearly, it was in Tropical Asia though that the highest loss did occur in relative terms.

Deforestation factors

42. The 1980 FAO/UNEP Tropical Forest Resources Assessment Project ascertained that in the three tropical regions taken together, shifting agriculture was responsible for 45 percent of the 11.4 million ha deforested each year (almost two thirds in Tropical Africa, about one half in Tropical Asia, and almost one third in Tropical Latin America). This means that shifting agriculture was then encroaching annually by more than 5 million ha in the closed (3.4 million ha) and open (1.7 million ha) forests. The remaining 55 per cent of deforested areas were attributed mainly to the following factors:

Tropical America

Ranching, colonization programmes, and non-rotational subsistence agriculture accounted together for approximately 50 to 55 per cent of the deforestation that was occurring in closed forests. In open forests complete deforestation for fuelwood and charcoal gathering was a major factor, particularly in Brazil.

Tropical Africa

The bulk of the remaining deforestation was attributable to the expansion of permanent cash crop agriculture (coffee, cocoa, palm oil, rubber) in the closed forest, and to over-exploitation for fuelwood and overgrazing in the open tree formations.

Tropical Asia

Some 35 to 40 per cent of the remaining 50 per cent of deforested areas in closed forests was attributable to colonization/area development programmes, some linked with the development of cash crops (rubber in South-East Asia, cassava for industrial purposes in Thailand, coffee and cocoa) and to non-rotational subsistence agriculture (e.g. "squatters" in the Philippines). Most of the deforestation in open forests was due to overexploitation for fuelwood and overgrazing in dry areas.

43. Structural reasons for deforestation and forest degradation are important. Given that clearing for agriculture is the prime direct cause, it is the local population that can bring about a change. However, the local people do seldom own the land and do therefore have little incentive to care for the forest or for soil conservation. In the success stories that can be found in the world, ownership or some long term land tenure rights have usually been part of the background.

Forest degradation

44. Forest degradation corresponds to progressive changes and these are often less easy to detect and quantify than the different types of clearing. This is one of the reasons for which there are few precise data available on the corresponding losses in forest resources at the level of large geographical entities. It is important to note that degradation of the woody component of natural forest formations often goes together, particularly in the case of open formations, with the degradation of other components of the ecosystem, especially fauna, soils and the herbaceous layer.

45. The major factors of degradation include, selective exploitation of high valued species, over-exploitation for fuelwood, over-hunting, over-grazing, and repeated fires. Their effects are often combined, as in many regions of the African savannas and in the pine forests of Central America. Other causes of degradation are diseases and insects, natural calamities and particularly cyclones, and war damage. Logging is often a factor of degradation but it need not be if the layout of roads was carefully studied, roads carefully constructed, and appropriate efforts were made to reduce the effects of excessive selective felling and the damage caused by felling and logging.

Current status of forests

46. For the purpose of this section by the word "forest" is meant any vegetation type whose trees cover with their crown at least 10 to 20 per cent of the ground; while the word "tree" is meant "woody perennial plants

typically large of more than 7 metres height* at mature stage and with a single well-defined stem carrying a more or less definite crown".

47. The diversity of forest types can vary enormously. The first reason for this is the wide range of ecological conditions under which they grow. A very large number of forest vegetation classifications exists at global, regional, subregional and national levels which use various criteria (ecological, physiognomic, physiographic and other). The UNESCO "International Classification and Mapping of Vegetation" and the Josef Schmithusen "Atlas für Biogeographie" are two important authorities at world level. The latter, for instance, distinguishes some thirty types of tropical and sub-tropical forests and woodlands, and approximately the same number in the temperate, subtemperate and Mediterranean zones, and six types of boreal forests. Less complex but still to be considered is the high latitude forest found in the southern hemisphere in South America. To these must be added the large number of other woody vegetation types, especially the shrub formations and scrubs.

48. Diversity of forest types also results from the past and recent history of human interference (forest clearings, logging, grazing, fires) and by other human-induced and natural factors (air, soil and water pollution, pests, diseases, hurricanes).

Extent and distribution of forests and other wooded lands

49. Table 1 pictures the situation in terms of areas of forests as at end 1980, date of the last comprehensive survey of world forest resources carried out by FAO (in cooperation with UNEP for the tropical countries, and with the UN Economic Commission for Europe for the developed countries). It shows that 10 years ago forests covered an estimated 3.6 billion ha (36 million Km^2), 27.6 per cent of the total land area (excluding Greenland and Antarctica) of our planet. Forests of the tropical countries and territories covered some 1.95 billion ha (54 per cent of the world total forest area), representing 40 per cent of their land area.

50. The preliminary results of the new tropical forest resources assessment being carried out by FAO indicate that the total forest area of the tropical countries and territories may have been reduced by 1990, i.e. 10 years later, by a further 200 million ha since its estimate made earlier with 1980 as the full reference year. Though full information is not yet available, there are indications that the overall change in forest area for the rest of the world during the last 10 years is small in comparison with that occurring in the tropics. Forest areas in the boreal and temperate parts of the world in 1990 are, therefore, close to those of Table 1, while the total forest area of the tropical countries/territories and that of the whole world have to be reduced by 200 million ha.

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* This minimum tree height (and maximum shrub height) must be interpreted with flexibility and may vary between 5 and 8 metres approximately.

TABLE 1 - AREAS OF FORESTS AT END 1980 BY CONTINENTS AND MAIN ECOLOGICAL ZONES

(in million hectares and in per cent of land areas)

SOURCE: FAO 1991

ECOLOGICAL ZONES	CONTINENTS (with related islands)	Africa	America	Asia (without Asian part of USSR) a/	Pacific	Europe (including whole of USSR	TOTAL
BOREAL COUNTRIES b/	Number of countries/territories b/	0	2	0	0	4	6
	Total (boreal) land area	0	910	0	0	1 280	2 190
	Total population (in millions)	0	4	0	0	39	43
	(Boreal) [in millions ha] forest area [in percent of (boreal land area]	0	203	0	0	717	920
		0	22.3%	0	0	56.0%	42%
TEMPERATE COUNTRIES/ TERRITORIES (including MEDITERRANEAN and SUB-TEMPERATE	Number of countries/territories c/	10	11 c/	22	3	32 c/	78 c/
	Total (non-boreal) land area	727.3	1 331.1	1 755.9	788.5	1 420	6 023
	Total population (in millions)	119.6	290.4	1 316.2	17.9	710.8	2 454.9
	(Non-boreal) [in million ha] Forest area	8.1	310.8	188.4	48.7	211.5	767.4
	[in percent of (non-boreal) land area]	1.1%	23.3%	10.6%	6.2%	14.9%	12.7%
TROPICAL COUNTRIES/ TERRITORIES	Number of countries/territories	46	39	22	21	0	128
	Total land area	2 237.3	1 651.6	921.4	54.4	0	4 864.5
	Total population (in millions)	359.9	318.9	1 267.1	5	0	1 950.9
	Forest area [in million ha]	701.2	889.8	303.4	42.6	0	1937
	Forest area [in percent of land area]	31.3%	53.9%	33.7%	78.6%	0	40.0%
ALL COUNTRIES/ TERRITORIES	Number of countries/territories	56	50	44	24	32	206
	Total land area	2 964.6	3 892.7	2 677.3	842.9	2 700	13 077.5
	Total population in millions	479.5	613.3	2 583.3	22.9	749.8	4 448.8
	Forest area [in million ha]	709.3	1 403.6	491.8	91.3	928.5	3 624.7
	Forest area [in percent of land area]	23.9%	36.0%	18.4%	10.8%	34.4%	27.7%

a/ Asia includes the Middle and Near East.

b/ Six countries are classified as "boreal" because they have forests in the boreal zone (Canada, Finland, Norway, Sweden, USA and USSR). Greenland and Antarctic territories, which have no forests, are not included.

c/ Including the six countries classified as boreal, which all have temperate forests.

51. Other wooded lands also occupy large areas. They can be grouped into three main categories, i.e. vegetation types whose trees cover less than 10 to 20 per cent of the ground with their crown; scrubs, thickets and shrub vegetation types; and forest fallow, mostly in the tropical zones, made up of all complexes of woody vegetation derived from the clearing of natural forests in shifting cultivation systems. In 1980 these other wooded lands were estimated to cover some 1.7 billion ha (17 million Km^2) or 13 per cent of the total land area (excluding Greenland and Antarctica) of the world (1.05 billion ha in the tropical world and 0.65 billion ha outside the tropics).

"Natural" forests

52. Forest area figures given in Table 1 include the "natural" forests and forest plantations. The expression "natural forests" must be better understood. Only a small proportion of these forests are "climax", i.e. resulting exclusively from the past and present influences of ecological factors. In the humid tropics, a significant part of the so-called "primary" forests have been altered by anthropogenic action in historical times. In particular, they may have been cleared for cropping and grazing long ago and then left to reconstitute themselves (as has been the case in some historical sites like the Maya settlements in Mexico and Guatemala or the Angkor-Vat region in Cambodia and are, thus, old secondary forests. The same process applies to most forests in the developed countries.

53. It is easier, under the current assessment methodologies to identify and estimate the areas of undisturbed forests, i.e. those forests which have not been either cleared or logged in the recent past (say 60 to 80 years). In 1980 undisturbed but potentially exploitable closed forests in the tropics (rainforests and other types) amounted to some 670 million ha. In the late 1970s 2.0 million ha. were being cleared and 4.4 million ha. logged annually. Taking into account the increase in rates of clearing during the 1980s, their area may have been reduced to some 590-600 million ha in 1990. To this area must be added that of most closed forests left unused because of their inaccessibility or for legal reasons (protected areas). Their area amounted in 1980 to some 310 million ha and can be roughly estimated at 290 million ha in 1990. Only a very small part of the woodlands of the dry tropics is undisturbed, since practically all these stands are affected by naturally or intentionally caused fires, by grazing and by extraction of fuelwood and other forest products. In the temperate and boreal zones of Europe and North America some 420 million hectares were not disturbed in the early 1980s, either because they were not commercially exploitable or were located within protected areas. To give a comprehensive picture, to this figure must be added the areas of undisturbed forest of other temperate zones of the world (Argentina, Australia, Chile, China, New Zealand, Japan, Korea, Mongolia, Nepal, Western Asia, Northern and Southern Africa) where the total forest areas amounts to some 300 million ha.

Management of forests for production

54. Though regulations of the temperate forests appeared to have existed in Europe in ancient times, it is only since the sixteenth century, and particularly since the nineteenth century, that harvesting regulations as well

as silvicultural treatments were first introduced. This was in the form of management (or "working") plans for the forests whose main management objective was the production of wood and, possibly other products.

55. In the boreal zone, the Scandinavian countries have carried out sustainable utilization of productive forests through fairly intensive management for several decades. Sustainable forest management has been achieved to a lesser degree in parts of Canada and in the boreal forests of USSR. In the developed countries the general rule is that management is practised at varying levels of sustainability in the publicly-owned forests (State and communes mostly) and in those owned by industries whilst the care given to forests owned by the private sector varies from one country to another. Some temperate developing countries have introduced management, particularly in plantations of exotic species and very occasionally, mostly as case studies, in indigenous forests. In the tropical zone an estimate of only 4.7 per cent of the productive closed forests were considered to be managed in 1980 (42 out of the 885 million ha). Of this area, 37 million were found in South Asia alone, mostly in deciduous forests (e.g. teak and sal forests). In tropical Africa and America forest management of native forests exists mainly in the form of experimental and pilot projects.

Management of forests for conservation

56. In the tropical zone the total area of closed and open forests within national parks and other protected areas was estimated at 87 million ha or 4.4 per cent of the total forest areas. The level of implementation of management plans varied from non-existent to satisfactory, depending on the countries and protected areas within those countries. In comparison, at the beginning of the 1980s some 58 million ha of forests were included within "national parks and nature reserves" in Europe, USSR and North America.

Remote sensing and assessments

57. Remotely-sensed data from a variety of satellite and airborne platforms can play a significant role in mapping and monitoring the world's forests, with a current research emphasis on detecting tropical forest extent both within and outside the United Nations system (FAO, UNEP, JRC-Ispra, NASA, Wood's Hole Research Centre). At least three operational satellite systems are most frequently used for forest detection, mapping and monitoring at different scales and with different resolving powers. These are the NOAA meteorological satellites and their Advanced Very High Resolution Radiometer (AVHRR) sensor (USA), the LANDSAT satellites with MSS and TM sensors (EOSAT, USA) and the SPOT satellites with HRV and panchromatic capabilities (SPOT-Image, France). While the cost of NOAA data is low and has remained stable in the recent past, the cost of both LANDSAT and SPOT data is relatively high in both absolute and per-area terms, and historically has been rising.

58. The NOAA system, however, was not designed for terrestrial mapping or monitoring purposes and , while it has advantages for regional studies its spatial resolutions are limited to approximately one kilometre. The LANDSAT and SPOT systems, on the other hand, have relatively high resolutions (from

80 metres up to 10 metres) and high data volumes per area. However not only is the price prohibitive to acquire such data over large areas, but that the time and cost of data processing also can be restrictive. There are recent indications that the cost of such higher resolution data is declining in some cases, but not for current data which may be needed for forest monitoring or change detection purposes. However, historical studies in small regions could possibly benefit from these lower costs, and might allow the establishment of baselines forest patterns as a reference against which more recent studies of forest extent could be compared.

Deforestation and degradation of forests

59. It is essential to distinguish between deforestation in the strict sense of the term, which occurs when a forest is cleared to give way to another use of the land (e.g. agriculture, roads, dams, human settlements) and forest degradation when the species diversity and the biomass are significantly reduced through, for instance, unsustainable forms of forest utilization, such as over exploitation for wood and overgrazing. Deforestation may be the ultimate stage of forest degradation. This happens when the forest biomass is so much reduced that the crown cover of the trees is less than the minimum required to define the stand as a forest, unless this reduction is only temporary (temporarily "unstocked" forest which is regenerated artificially or left to regenerate naturally). This type of deforestation occurs as the penultimate stage of degradation and is found, for instance, around large cities in the Sahelo-Sudanian zone where woodlands are being over-exploited. Deforestation ultimately produces land degradation whereby the soil loses the ability to sustain plant growth. This in turn culminates in sheet and gully erosion in humid and sub-humid zones or desertification in arid and semi-arid areas.

Deforestation

60. Many developed countries have suffered from deforestation in the past. Some of them are only recently recovering from the effects of such deforestation while several are still suffering from the occurrence of accidentally or intentionally caused forest fires causing serious damage as is the case in France, Greece, Spain, USA, USSR and others. Over 500,000 ha of forest and woodlands are affected by forest fire each year in the Mediterranean basin countries alone.

61. For the tropical zone, the FAO/UNEP Tropical Forest Resources Assessment Project estimated in 1980 that 11.4 million ha of closed and open forests were being cleared annually (3.7 million ha in tropical Africa, 5.7 million ha in tropical America and a 2.0 million ha in tropical Asia or 0.53 per cent, 0.64 per cent and 0.64 respectively). The causes of deforestation in the late 1970s varied according to regions, with the expansion of the agriculture frontier being the most important overall single factor, accounting for 45 per cent of total overall deforestation. The highest percentage up to 70 per cent was in tropical Africa. Other important causes were ranching (in tropical America), colonization programmes (mostly in tropical America and Asia), permanent cash crop agriculture, and over-exploitation for fuelwood in the dry zones of Africa.

62. The practice of giving definitive ownership in previously forested areas to landless farmers once, and only if, the forest cover is destroyed is still common in several Latin American countries and probably also exist in Asia and Africa.

63. The preliminary results of FAO's Tropical Forest Resources Assessment 1990 Project covering 76 countries representing 79 per cent of the world's tropical forest cover in 1980, showed that between the period 1981-1990 the annual deforestation rate was as high as 16.8 million ha. Though this latter estimate needs to be refined through additional interpretation of remote sensing imagery and ground control, there is evidence that deforestation has accelerated throughout the tropics, except in those countries (notably in tropical Asia) where relatively little forest cover is left.

64. In the temperate, boreal and austral zones, deforestation rates have not been systematically assessed. The main reason for this is that deforestation has been generally considered as limited in contrast to what happens in the tropics, and is often compensated by afforestation and reforestation. Recent data on Canada is however indicating that over seven million hectares of forests were burned in 1989 in that country and that on average-risk years around two million ha are burned. In the southern Mediterranean countries and in Western Asia, forest degradation, mainly through overgrazing and overcutting, has lead to deforestation and complete denudation of large tracts of land. Information on deforestation in the temperate developing countries in Asia and America still needs to be further assessed.

Degradation of forests

65. In all parts of the world, whether boreal, temperate or tropical, forests are subject to various forms of degradation caused by a wide range of factors. Some of these factors are natural, such as pests and diseases (though some may be the effect of human intervention), storms and hurricanes and other climate hazards like droughts and frosts. However, the most important causes of forest degradation nowadays originate from anthropogenic action: unsustainable utilization of forest resources, such as indiscriminate logging and over-exploitation for fuelwood, overgrazing, forest fires, air pollution and wars.

66. It is extremely difficult and costly to quantitatively assess forest degradation since, in particular, contrary to most forms of deforestation, changes corresponding to degradation are often gradual and cannot be perceived and measured easily from one year to the other. Quantitative data are generally lacking except when the changes are relatively rapid and can be characterized by good indicators, and the monitoring capability exists, as in the case of degradation caused by air pollution in the developed countries.

67. In the developing countries, particularly in the tropical zone, logging is a cause of degradation of forest ecosystems when its intensity is high (such as in Dipterocarp forests of South-East Asia) and when it is not carried out within the framework of sustainable management. Over-exploitation for fuelwood and charcoal, together with overgrazing and repeated bush fires, remain a serious threat in most dry zones of the of developing countries and particularly in the tropics, for example in Africa and South America. Fires

have also spread over wide areas of heavily disturbed forests in the humid tropics during the 1980s, facilitated by particularly dry weather conditions (Kalimantan in 1982, Cote d'Ivoire in 1983; Brazil in 1987 and 1988).

68. In the Mediterranean zone, the most serious threats combine overgrazing and fires. In the southern European countries in the mid 1980s FAO reports some 30 to 40,000 fires which affected annually some 700,000 ha of forests and other wooded lands.

69. The fire risk situation is less serious in the boreal and temperate zones, except in some cases when a conjunction of unfavourable events (prolonged drought, strong winds, and late detection and control) may cause huge fires (northern China in 1988; Yellowstone Park, USA, in 1988; and, Central Canada in 1989). Even though pests may play a major role, the main cause of forest degradation in the developed countries, all of them located in the temperate and boreal zones, has been, for the last ten years at least, the result of local and transboundary air pollution. In 1988 the compilation of the forest damage survey (Forest Damage and Air Pollution: Report of the 1988 Forest Damage Survey in Europe ECE/UNEP, 1988) carried out in European countries and some USSR Republics revealed that between 0.6 per cent (Portugal) and 5.4 per cent (Czechoslovakia) of all trees were severely defoliated or dead, with an additional 0.7 per cent (Portugal) to 22 per cent (Czechoslovakia) with a moderate defoliation and that in more than 18 countries over 30 per cent of the forest areas were affected. Forest damage as a result of air pollution is also observed in industrialized and densely populated areas of North America and East Asia and, specially around large urban concentrations throughout the world.

70. Deforestation and forest degradation have many and important negative consequences for the food security and well-being of present and future generations. Their effect in especially sensitive areas such as mountain ecosystems is particularly serious with further consequences on water cycles, soil and snow stability and the loss of genetic diversity found in these areas. The Andes, the Himalayas and the Alps, among others, are examples of such impact. Two consequences of global concern which should be underscored are the loss of biological diversity, and the impact on climate.

Afforestation and reforestation

71. Afforestation is plantation of forest trees on land which previously did not carry forest, while reforestation is plantation on land which carried forest within living memory and involves the replacement of the previous forest cover with a new, and often essentially different one.

72. FAO estimated the total area of plantation forests existing in 1980 in the tropical countries at 11.5 million ha, and that for the whole developing world (including the tropical and temperate countries) at some 29 million ha. The annual rate of successful planting for the period 1981-85 had been projected ten years ago at 1.1 million ha. Given the regular increase, during the 1980s, of the rate of plantation establishment, particularly at community and farm levels, the total area of plantation forests is likely to have reached 25 million ha in 1990 in the tropical countries alone.

73. It is important to note that the above refer to plantation of forest trees in stands or blocks. However, the plantation of individual trees in lines (e.g. windbreaks and shelterbelts, roadside planting) or separate and scattered (e.g. in homestead gardens), and the planting of perennial cash crops (such as rubber and oil palm) must also be taken into account and they have great significance in most countries. The latter type of plantation increase the estimates given in the previous paragraph.

74. The subject in general is increasingly attracting the attention of specialists and governments. A series of workshops and seminars have been recently organized to analyse problems, their causes and to seek for practical solutions such as the Technical Workshop to explore options for global forest management, held in Bangkok, Thailand (April, 1991).

75. It is still not easy to have precise estimates of planted areas due to the difficulty of separating areas regenerated artificially within the framework of forest management plans from those being planted and also because of the general lack of regular systematic collection of data.

SECTION II

THE VALUE OF TREES AND FORESTS

The economic value of trees and forests

76. The basic reason to value the contributions of trees and forests to human welfare is to provide a better basis on which to make decisions about their use and protection. Economic values are traditionally used to compare different uses of resources on a common basis; and many decisions are based on judgements concerning trade offs in benefits and costs (values). Thus, having a better idea of values of the multiple outputs (goods and services) from trees and forests will help to take better decisions on their future.

77. Forests means something different to different people. This perception may vary in space and time and so can its value. In general terms, however, most of the methodologies used up to now to assess the economic value of trees and forests have been based on their capacity to produce timber of a certain quality or the value of that timber in the local or remote markets. Even the replacement value of fuelwood collected for local consumption or marketing is often not included in the value calculations. Very little, if any, of the other goods and services produced by the forests have been considered in this quantification. More recently, some efforts have been made to find ways through which a more comprehensive view could be given to the value of forests. But universally accepted methodologies are not yet available.

78. One major problem in calculating a comprehensive value of forests is that the costs and benefits linked to this resource are not necessarily charged to or received by the same people. For example, firewood, wildlife and medicinal plants may benefit the local dwellers while hardwood logs will have more attractive markets far away from the forest. At the same time the greenhouse gas storage capacity of a forest will play an important role perceived mainly at a global level while it has little importance if any to the local farmer. Its role as a regulator of the water cycle will be of higher interest to the

farmer in the lowlands than to the one in the highlands. The value of forests and their products also varies according to the cultural and market values and strongly depends on their relative geographical location.

79. Several recent initiatives have been studying the subject of forest values including work by the IIED, the Harvard Institute for International Development, WRI, WWF and many others. A joint project is now being developed by FAO, UNEP, the World Bank and the University of Minnesota which is geared towards the development of methodologies to assess the value of forests under different condition and with a more comprehensive approach. Its results are expected to be available by early 1992.

80. It should be pointed out, however, that decisions concerning the use of forests, are not necessarily made on the basis of a comparison of costs and benefits using traditional economic science approaches. Rather, a great number of political, social, cultural and religious factors enter the picture. This is not unique to developing countries.

81. Despite this fact, economics probably enters the decision-making process more than we commonly think. The problem often is one of "values from whose point of view?". For example, from the point of view of a slash and burn farmer, it may be very rational from an economic point of view to move on to the next hectare of forest: he has no choice if he and his family are to survive. Thus, the value he attaches to cleared land far exceeds any value he might attach to the standing forest, which, in any case, will still surround his plot. From the point of view of someone living comfortably in a city, the opposite may be the case. What matters, of course, is the values used by the decision maker, the person who actually determines what happens to the forest.

82. A central point about any economic values attached to the multiple outputs of forests is their relative nature. There is no absolute economic value associated with the multiple uses of forests. Values attached to such uses depend on demand and supply at any given time and place and on the availability of substitutes. Values also depend on power, or on who controls resources in the broadest sense.

Approaches to valuing the multiple contributions of trees and forests to human welfare

83. There are many different types of economic values associated with natural forests. A convenient classification is presented in the following table:

Comments on the classification of values

84. Many of these values can be estimated using a variety of techniques, assuming that the data are available to quantify the basic physical/biological relationships involved. Unfortunately, in most cases there are vast gaps in our understanding of these physical/biological relationships, e.g., in the case of the forest's role in the carbon cycle and how to specify what contribution a specific area of forest makes as a sink for greenhouse gases. Without such information, the economist cannot proceed to develop value measures.

CLASSIFICATION OF MULTIPLE USE VALUES OF FORESTS

I. USE VALUE OF FORESTS

DIRECT VALUES	INDIRECT VALUES
1. Consumptive:	1. Ecological services.
1.1. Local consumption;	2. Watershed protection.
1.2. Commercial/industrial C.	3. Protection of species & genetic diversity.
	4. Carbon sink capacity
2. Non-consumptive:	5. Soil formation and fertility.
2.1. Visual resources;	6. Socio-cultural values.
2.2. Recreation;	7. Living environment for indigenous people.
2.3. Research/education.	

II. NON-USE VALUE OF FORESTS

DIRECT NON-USE VALUES	INDIRECT NON-USE VALUES
1. Existence values.	1. Value of keeping the ecosystem functioning, preserving species, etc
2. Option values.	
3. Future generations.	
4. Others' use of resources.	
5. Others' level of well-being.	

III. RECOMMENDATIONS FOR THE FUTURE

1. QUANTIFY THE MULTIPLE OUTPUTS;
2. ASSESS DISTRIBUTION OF COSTS & BENEFITS FROM FOREST USE;
3. ANALYSE VALUE PARADIGMS USED BY DECISION MAKERS;
4. DEVELOP AND IMPLEMENT RATIONALE FOR DECISION-MAKING REGARDING NON-ECONOMIC VALUES.

85. Further, in the case of the value of biodiversity, and particularly the value of biodiversity contained in a specific forest area, the economist faces almost complete uncertainty. It simply cannot be known what the future holds, when another medicinal plant of interest to the chemical industry such as the rosy periwinkle will emerge and what its value will be in terms of the contribution of the forest. Thus, useful economic values cannot be attached to such potential outputs from the forest.

86. In sum, this deals with a very complex situation, because of: I) the dynamic and interactive nature of forests and their outputs; and, II) the relative nature of economic values, both in terms of uncertainty about supply and demand conditions in the short and long term perspective and in different locations, and in terms of the varying value perspectives of different decision makers who actually will decide the fate of a given forest.

General observations regarding watershed values

87. Although in some cases it may be possible to restore watershed vegetative cover, soil fertility, wildlife habitats, etc. in general it should be noted that not only is prevention of damage/degradation much more economical than cure/restoration, but that in most cases it is the only means at our disposal. The economic value should not therefore be related to the cost of restoration, but to the value of the resource/service function for present and future generations.

Watershed protection

88. The scale of watersheds to be protected and hence the issues involved varies from small scale irrigation and municipal water supply schemes to national level protection of uplands for hydroelectric works, and the mitigation of the effects of floods and droughts. National and international river basin management is considered beyond the scope of this analysis.

89. The values of watershed protection can be divided roughly into values for water resources conservation and development (hydroelectric power, irrigation, municipal water supply, navigation, etc.), and for protection against natural disasters (torrents, avalanches, floods, mudflows, landslides, etc.).

90. In all cases watershed protection for downstream values needs to be seen in direct relation to these. Mudflows cause only very limited damage if they pass through uninhabited zones. However, they are rightly feared for their devastating and deadly effects in densely populated areas. Floodplain damage is directly related to floodplain occupancy, and agricultural and industrial development. The difficulty, however, lies not so much in estimating the values to be protected, as in estimating to what degree the effects of natural phenomena will be mitigated or completely avoided through forest watershed protection.

91. A dangerous tendency in the past has been to consider damage to watershed values either as reparable (rehabilitation), or as only implying increased operating costs (dredging, water treatment, closing down intakes during storms, etc.), and even replaceable (new dams, new water intakes, deeper wells, etc.). Whereas this may be acceptable in short term technical/

financial analysis, it will become increasingly evident that it is uneconomical in terms of long term water resources development, and unacceptable in terms of environmental costs. It is also unsustainable in the sense that it affects the alternatives available to future generations. Good dam sites are a finite resource, and habitats (inundated) are usually lost forever.

Flood prevention and control

92. As stated above forests will have only limited effects on disastrous flood events. Such events occur when large parts of the river basin receives rainfall exceeding the temporary soil storage capacity. Much of the flood water may originate from the lower river basin itself and forests in the uplands will have very limited effects in such cases. The economic value of forests in relation to floods is that they may allow for agricultural and even industrial development on floodplains because they contribute to the mitigation of the effects of small and medium, and therefore relatively frequent, floods. If damaging floods occur only every 20-25 years instead of every 3-5 widely different land use options become economical: plantation forestry, fruit trees, cash crops, brick making, etc. versus mainly grazing or annual crops with frequent floods.

93. Rice cultivation represents a special, but very important case. Food security for hundreds of millions of people is dependent on the balance of flood water and sediments produced annually during the growing season. Forests play a vital role in maintaining this balance, often with a very narrow relationship between uplands and nearby lowlands.

Soil protection and conservation

94. It is practically impossible to give a global market value to a cubic metre of soil. The value of forests in soil protection and conservation is depending of the value of the land and the soil being protected, which again is depending on the land use alternatives available as a result of this protection. Shelterbelts may not only allow the cultivation of annual crops, but also contribute to the reduction of dust storms affecting human health, and of damage by wind and moving sand dunes.

95. Although soil degradation may be less irreversible than the disappearance of suitable dam sites, the same considerations concerning environmental accounting and sustainability in terms of future generations need to be applied to soil conservation and land values.

SECTION III

ROLE OF FORESTS

Introduction

96. For many years, forests have been considered mainly as land covered by trees from which timber or firewood could be extracted, or which could be converted to what was considered to be more economically productive uses, such as agriculture and cattle ranching. During the last two decades an evolution

towards a more comprehensive view has prevailed, which takes into account the full range of other goods and services produced by the forest: provision not only of timber and firewood, but also of plants for medicinal and other uses, food and fodder, resins, wildlife, as well as provision of environmental services, such as the protective role of forests for the conservation of soil, water, genetic resources and biological diversity, scenery and shelter. The recent highlighting of the role of forests as carbon sinks to reduce the effects of CO_2 in the atmosphere, and thereby helping to contain warming of the atmosphere, has extended the services rendered by the forests to a global level.

Forests as a Source of Energy for Rural Communities and Alternative Sources of Energy to Combat Deforestation

97. Fuelwood and charcoal supplies over 75 per cent of the total energy use in several developing countries such as Bangladesh, Ethiopia, or even oil producing countries such as Nigeria. In Central America it supplies over 50 per cent of the total household energy consumption and goes over 72 per cent when referred solely to rural areas. Over 30 per cent of urban households in Guatemala use firewood and 14 per cent a combination of firewood and Kerosene/Propane. These figures go up to 52 and 12 per cent respectively in small urban areas and to 79 and 3 in rural households. Information regarding the overall volume of production and demand has proved to be still incomplete particularly for firewood consumption in small industries in urban and rural areas. Estimations for those countries indicate that industrial use of firewood for bakeries, tobacco curing, brick manufacture is using the equivalent to 86,000 hectares of fast growing tree plantations per year or 3.5 million cubic metres. The wood share of total energy consumption was 74 per cent in Sudan, 92 per cent in Tanzania and 96 per cent in Burkina Faso in the early 1980s. Consumption exceeded supply by 30 per cent in Sahelian countries, by 70 per cent in Sudan and India and by 200 per cent in Niger.

98. It would appear that in the conversion of forested land to other uses, opening woodlands for agriculture has a more significant effect than fuelwood demand, which is an aggravating factor in the process.

99. Over 2,000 million people use wood for domestic heating and cooking and projections for the year 2000 suggest that, without remedial action to improve the situation, 2,400 million people will by then either be unable to obtain their minimum energy requirements or will be forced to consume wood faster than is being grown. By the year 2000 the world fuelwood deficit could reach 960 million cubic metres a year, the energy equivalent of 240 million tonnes of oil a year. That is, at current oil prices of around $US 20 a barrel, over $US 30 billion a year.

100. The Nairobi Plan of Action adopted at the United Nations Conference on New and Renewable Sources of Energy (Nairobi, August 1981), recommended that the annual rate of tree planting in developing countries be increased by a factor of five by the end of the century. Unfortunately little action has been taken on the basis of this recommendation. Current estimates indicate that on average every person in the developing countries consumes about 0.45 m^3 of wood as fuelwood or charcoal a year.

101. In general, biomass based energy systems, if well managed, can form part of a matrix of energy supply which is environmentally benign and can contribute to sustainable development. Impacts derived from biomass based energy systems may be less damaging to the environment than those of conventional fossil fuels since they produce local and limited impacts on their surrounding environments, compared with the larger impacts distributed over greater areas by fossil fuels.

102. As compared to the number of people involved and their lack of access to alternative fuels, the fuelwood crisis and its concomitant problems in the developing countries have received insufficient attention and assistance from the international and bilateral community

103. There is the likelihood that the crisis will persist into the twenty-first century, unless there is a serious re-thinking of the crisis, its causes and problems, on the part not only of the donor community, but also on the part of the developing countries themselves, by giving a significantly higher priority to this issue in their overall development plans, particularly in their energy and forestry policies and strategies.

104. When evaluating the potential of forest and trees biomass for energy purposes due attention should be given to the demand of the rural and urban poor, but also to the demand for charcoal from other levels of the society and from some specific industrial needs, such as manufacture of pig-iron, bakeries, etc.

105. This decade may be the most appropriate time for the relevant assistance agencies and concerned countries to increase efforts to achieve self-reliance and wherever possible self-sufficiency in fuelwood needs as well as to significantly augment their technical capabilities in this sector. For example, despite the effects of the fuelwood crisis as a factor in deforestation it is not seen as a matter of major concern in many countries where 'free' open-access wood resources, the bulk of which are Government owned, still account for 80-90 per cent of the supply both for charcoal and for direct firewood use.

106. The strategies to ameliorate or solve the fuelwood crisis have generally consisted of, or included, the establishment of fuelwood plantations ranging from large scale semi-urban plantations to small scale rural woodlots. The former have in many cases failed in alleviating the problems of the poorer sectors of the population due mainly to the high cost of its establishment ranging from over $US 800 up to $US 7000 per hectare; and their competition for land space with agriculture.

107. Failures in earlier small rural woodlot projects have often been due to the focusing on the production of fuelwood without due consideration of other products - which fetched higher and quicker prices.

108. Experience has shown that fuelwood shortages are real, but that they need to be addressed by focusing on the role that trees play in the socio-economic and cultural life of rural people. Community forestry approaches should help develop locally appropriate solutions for ensuring that fuelwood supplies are adequate and truly obtainable. Such efforts should give due attention to the

demand side and the markets and pricing structures. This could be complemented with action oriented towards wood-use efficiency, such as the promotion of improved stoves and improvement in charcoal production systems.

109. Alternative energy sources such as solar energy, wind energy and biogas have, so far, not had an impact in rural areas in developing countries, nor has resulted in any notable decrease of fuelwood consumption. These alternatives which are technology intensive have little opportunity to penetrate low income rural areas without intensive governmental intervention including the supply of equipment (and spare parts), subsidies and training.

Assessment of the role of forests as habitats of biological diversity

110. Natural forests and woodlands contain not only woody species and wild animals but a wealth of other species of actual or potential socio-economic importance at the global, national and local levels, including microorganisms and wild relatives of important crop species. Among them the tropical ones are the most complex ecosystems in the world in terms of species composition and interactions, structural variability and biological and ecological functions. Other forest ecosystems should not, however, be neglected as they contain species and genetic diversity specific to their location in latitude and altitude.

111. In addition to their plant components, forests constitute the habitat for associated wild animal species from micro-organisms, insects, and vertebrates such as mammals, birds and fish faunas, as well as temporary feeding areas for migratory species.

112. Genetic losses and extinction of plant and animal species are today occurring at an increasing pace, due mainly to pressures on and consequent loss of natural ecosystems, and to selection and genetic improvement of some species without due concern to conservation of the original resource base.

113. In 76 tropical countries, representing 97 per cent of the global tropical forest area in 1980, the total area of broadleaved closed forest was over 1,160,000,000 ha, of which 39,384,000 ha or some 3.4 per cent layed within legally protected areas. In addition, there was a total area of 34,255,000 ha of coniferous forest of which 1,360,000 ha or approximately 3.9 per cent was legally protected.

Strategies of conservation

114. The values derived from genetic resources are associated with the different levels of organization of diversity that exist in nature, from ecosystems to species, populations, individuals and genes. In considering the conservation of genetic resources, it is of utmost importance to clearly specify objectives aimed at as it is possible to conserve an ecosystem and still lose specific species; and to conserve a species and lose genetically distinct populations, or genes which may be of value in adaptation and future improvement of the species. Conversely, the loss of an individual species, of distinct populations or of individuals or genes, may pose a threat to the continued existence of the specific ecosystems of which they are part.

115. There are two basic strategies for genetic conservation, in situ (on-site) and ex situ (off-site, i.e. in genebanks, arboreta, botanic gardens, etc.). These two strategies are complementary and should be carried out in parallel in the case of conservation of species and intra-specific genetic variation; ecosystem conservation is, by definition, done on-site, however, as stressed above, it must be carried out in parallel with conservation in and ex situ of component species and their genetic variation.

116. Provided basic, genetic principles are applied and sustained, managed utilization of the forests can be compatible with in situ conservation of genetic resources. Harmonizing utilization and conservation is a key to genetic conservation, in the short as well as long term.

117. Two broad strategies have been devised to conserve wild animals. The first is to direct effort at the protection of individual species and the second at the protection of their habitats. In practice, the combination of both approaches is generally necessary to maximize chances of success as it is unrealistic to hope to achieve the long term maintenance of a wild animal population unless its habitat is also maintained.

118. Wild animal conservation strategies have also used "flag ship species", where effort has been focused on a spectacular animal species (e.g. Tiger) and its habitat, which at the same time will benefit other animal and plant species of the related ecosystems.

Methodologies of conservation

119. The general principles of conservation are the same for all living organisms. However, the strategies and methodology of conservation will vary according to the precise objectives of conservation, and the distribution and biological nature of the material to be conserved. Information on species distribution, variation, variation patterns and their biology and genetics, is needed to elaborate sound methodologies of conservation. However, the time available to save valuable ecosystems and species is too short to carry out accurate eco-geographic surveys and detailed species or ecosystem-specific research prior to initiating action. There is no real justification in delaying conservation activities in target species/ecosystems.

120. Many species cannot, at least with present knowledge, be conserved outside of their habitat and in the absence of the associated species found in the ecosystem in which they occur. The conservation of a range of representative ecosystems is therefore necessary. While attitudes and many of the needs of future generations cannot be reasonably predicted, we have a clear responsibility to keep options open and to prevent, to the best of our ability, the depletion or destruction of natural areas and the genetic diversity they contain.

121. At the national level, wild animal species are usually protected by legislation which prohibits or restricts the killing or taking of the species concerned. Such direct protection, which is subject to the level of enforcement of the regulations, is supplemented by indirect measures which prohibits or control such matters as possession and trade in animals or their

products. At the international level these latter may be regulated by international agreements (e.g. The Convention on International Trade of Endangered Species, CITES).

122. The protection of areas for wild animal conservation is achieved by the legal establishment of appropriate categories of protected areas and planning and managing them to maintain the wild animal populations they contain. Such individual protected areas in turn could form the components of a national and international system, covering all forests and other vegetation types.

123. Conservation of biological diversity should become part and parcel of plans for sustainable management of forests. Due consideration should be given to the ecological requirements of endemic and migratory species. Although the protection of highly sensitive areas should be given a significant priority, the role of trees and shrublands outside protected areas should be one important component of biological diversity conservation. Finally, action could be oriented in a way which will ensure biological diversity conservation of most if not at the different types of forests and not only focused in few ranges , selected on the basis of their high endemism or number of species. (See also report on Biodiversity Doc: A/CONF.151/PC/65).

Forests and climate

Contributions of Deforestation and Forest Fires to the Greenhouse Effect

124. Forests can contribute to slowing the rate of global climate change. However, it must be kept in mind that the major source of carbon dioxide, the principal greenhouse gas, is still the burning of fossil fuels. Forests can provide some relief to what must be considered primarily an energy problem.

125. Forests and forestry are important elements in respect of climate change. Certain forest practices contribute to increased levels of greenhouse gases and global warming. Forests can reduce the effects of climate change by absorbing and storing atmospheric carbon. The forest ecosystem, productivity and health is affected by climate change.

126. The main source of the increase in atmospheric CO_2 comes from the burning of fossil fuels. Deforestation and burning of forests are additional sources. Wildfires, burning of open woodlands by human initiative to regenerate fodder for domestic animals and slash burning also adds to the level of greenhouse gases.

Forests and Mitigation of Climate Change

127. Green plants remove CO_2 from the atmosphere through photosynthesis. Forests are effective carbon "sinks" because they store atmospheric carbon for long periods as woody tissue. Therefore, an increase in the world's forest area is a potential way to reduce the rate of increase of atmospheric CO_2. This expansion could be encouraged where it is ecologically viable, socially acceptable and economically feasible in the broadest sense. An approach which includes management and protection of existing forests, reforestation or afforestation of appropriate areas and utilization of wood products to avoid carbon release would maximize opportunities forests offer to reduce the effects of climate change.

128. If efforts to expand the area of forest cover are based on sound principles of ecology and silviculture and done in coordination with rural development, they will also provide a number of benefits to human society over and above the reduction of greenhouse gases.

Effects of Climate Change on Forests

129. Forest may be both positively and negatively affected by climate change. Higher mean temperatures, increased levels of atmospheric CO_2 and increased precipitation could result in increased growth rates and productivity of some species, but climate change will induce the shifting and in a first phase reduction of the natural ranges of trees and other living components of the forest ecosystems, loss of genetic variability, loss of species and simplification of ecosystems, massive decline of forests and increased incidence and severity of wildfire.

Conclusions

130. Climate change will continue to be one of the foremost environmental issues for the remainder of this decade and well into the next century. If the world's forests are to be effectively utilized as carbon "sinks" and the impacts of climate change on forests are to be minimized, then work would have to be undertaken in a number of areas. Apart from measures related to energy consumption patterns, this would include measures to arrest deforestation and increase the net area of the world's forests through a combination of actions. Carbon storage could become one management objective in the development of forest plans, in addition to the production of wood and non-wood products, soil and water conservation, wildlife, recreation and the many other values forests can provide. It would be necessary to expand research to more clearly define the various interrelationships between different forests types and climate change, particularly with regard to the capacity of various forest ecosystems to sequester carbon; and design and implement monitoring systems to detect changes in the extent and condition of the world's forests which may be the direct or indirect result of climate change. Guidelines for environmentally and socially acceptable massive plantations schemes need to developed.

SECTION IV

THE ROLE WOMEN, ESPECIALLY IN DEVELOPING COUNTRIES, PLAY IN THE USE, CONSERVATION AND SUSTAINABLE DEVELOPMENT OF FORESTS

131. The first picture that comes to most people's mind when addressing this subject is that of rural women walking long distances under the heavy load of the family's daily need of firewood. Even though this is a current situation in most developing countries and probably also in some remote areas in developed countries the problem is even more serious than just that.

132. The participation of women in the decision making process in issues related with forest use and management has been practically negligible in most societies. The same happens in the operational process of planting trees, felling and logging operations, processing and marketing timber and wood

products. The only exception is probably the one of collecting and transporting firewood for household use in rural and sub-urban environments in developing countries.

133. The most fundamental causes of this situation can probably be found in deeper cultural, religious and behaviourial factors of the different societies which are related to security of the family nucleus, the maternity function, and the traditional performance of chores associated with the household environment. Experience has showed that in the initial steps of projects relying on or incorporating local people participation it is much easier to obtain mens participation and opinions than that of women. One reason may be the frequent domination by male staff in these initial contacts but even when female staff is involved it is still easier to involve the local men than women.

134. There are some valid examples of active women participation in trees and forest plantations at the village or community level as for example the Greenbelt Movement in Kenya but their results have been more substantive in educating the community and women in the effects of local organization to solve local problems than in resolving nation wide forest products requirements.

135. Typical forest operations such as felling, logging and transport for industrial purpose often take place in areas remote from permanent human settlements and operators prefer to hire solely men for seasonal or longer contracts to avoid providing housing and food facilities for workers relatives thus disrupting the family structure. Industrial forest plantations follow more or less the same pattern and women are only occasionally hired to participate in tending and maintaining seasonal or permanent tree nurseries. This pattern is in some way similar to what occurs in other extractive operations such as mining and fisheries. In most case it disrupts the family structure and forces one member of the couple, mostly men, to migrate to other areas to find employment and an income far from the family. Part of the income is then, hopefully, sent back to the household.

136. A similar pattern can be found in forest training and higher education where the sector has been mostly dominated by men. It is only in the last few decades and in some few countries where women, previously "banned" from forestry schools and universities have been accepted. For instance, in several European countries forestry training was, until rather recently, a men's only occupation and in some cases forest services were assimilated to "para-military" structures.

137. Despite this apparent disconnection between trees, forests and women, in reality women, and particularly women in the rural areas have a wealth of traditional knowledge and experience on the different uses of tree products. Their knowledge on the medicinal values of leaves, barks, flowers, roots, seeds and saps, the food and fodder value of the local species, the qualities of different firewood, etc. are an important asset.

138. It is however in the traditional societal structures where any action to encourage fuller women's participation is to be focused first. Even though there is no doubt that women are able to participate and perform any forest

related activity in equality with men, without changes in those societal traditions it will be difficult to ensure more women participation in forest related decision and activities. Efforts should be made to encourage or at least open opportunities for women in the forest sector. Their knowledge and experience in forest product use could be actively used in decision making processes and women's advise obtained in the design of forest plantations and managerial decisions.

139. In nearly every society trees are used, either in the fields, in the homestead, or in both, as a means of increasing soil fertility, preventing soil erosion, and altering micro-climates so that annual crops may grow better. Because women are aware of the utility of trees on the homestead, as more often than not it is women that run the homestead, they take good care to plant and maintain them. In many, if not most rural societies, it is the women who have accumulated the traditional knowledge about the foods and other household products that trees can supply.

140. Fuelling and tending the household fire has always been women's work and in most cases the same happens with the much harder job of collecting and transporting the fuel. One study has shown that in Nepal women and girls together collect 84 per cent of the fuel. Women have acquired an intimate, practical knowledge of the suitability of different tree species for cooking. Women know which trees burn slowly and which burn quickly, which smoke and kindle easily.

141. When the supply of fuelwood becomes scarce, much more than the family meal is threatened: the basis of village life is altered. Increasing fuel shortages may lead to dietary changes in the form of fewer meals per day and the preparation of foods that require less cooking. The increasing time required to collect fuel means less time available for other productive activities. Alternatively, additional expenses may be incurred in order to purchase fuelwood.

142. Of the many other products provided by trees, dyes and medicines are particularly important, and both are predominantly women's activities. A final household use of trees is the shade they provide round the homestead to people, cattle and poultry and allows the family to work and live under conditions that would otherwise often prove intolerable.

143. Small-scale, forest-based enterprises, such as the collection and processing of raw materials into useful products, are a major source of income for the poor, and especially for rural women, including those from landless families. The forest provides many materials that with care, skill and time can be turned into useful products - rattan canes for making furniture, fibbers to make nets, ropes and mats, bamboo for basketry, gums and resins, and leaves for making cigarettes wrappings. Because scarcity has so raised the price of fuelwood and charcoal, many women now add to their incomes by selling fuel they gather for others.

144. The advantages of all these activities are that the raw material is accessible, the work is seasonal and flexible - and can therefore be fitted in with the agricultural season and daily chores - and initial investment is low.

For many women, especially those in landless families or without access to common land, the collection of forest products, and fashioning them into saleable commodities, provide the only form of cash income they have.

145. The ways in which women traditionally use forest resources are becoming increasingly unviable. There are four main reasons for this, each of which has a cumulative, negative impact - directly on the well-being of rural women and their families and on the sustainable development of the natural resource base:

First, in many areas multi-purpose tree species are becoming increasingly scarce as desertification and deforestation take their toll.

Second, as more and more men migrate to the towns and cities - temporarily, seasonally, or even permanently, women are forced to perform the work previously undertaken by men. This leaves little time for the lengthy business of collecting and processing forest products, however important they may be to the family economy. Women gain new responsibilities but not the rights that should go with them.

Third, new technologies are changing land use, reducing the availability of minor forest products that women have traditionally used as a source of additional income. These technologies are frequently introduced without providing women with other income-generating alternatives.

Finally, development projects too often consider men as the sole actors in the working force. There is considerable potential for involving women in a wide range of forest activities, ranging from planning, implementation and research in the areas of agroforestry, nursery development, and afforestation to improved forest management and productivity. For that purpose women's specific roles and needs should be properly taken into account by policy makers, planners and project designers.

146. Apart from addressing the cultural and traditional elements which refrain or restrict women active participation in the formulation and implantation of projects affecting their households and community, policy, legal and administrative level decisions could enable their participation.

SECTION V

CURRENT LEVELS AND STRUCTURES OF THE WORLD TRADE IN TIMBER AND TIMBER PRODUCTS

Overview

147. World timber and timber products exports in 1989 were valued at $94.7 billion. Of these exports, $81.4 billion (86%) came from developed countries. In general terms the the main international flows of forest products are from developed countries to developed countries. Trade is primarily in unprocessed or semi-processed products, namely logs, sawnwood, and pulp and paper.

148. The main forest products exported are, in order of importance (by value), paper and paperboard, sawnwood, pulp, wood-based panels, and saw and veneer logs. (See Table). For most products the developed countries provide over 90 per cent of world exports.

World Forest Product Exports 1989

	$ billion
Saw and veneer logs	6.5
Sawnwood	17.4
Wood-based panels	9.3
Wood pulp	17.3
Paper and paperboard	41.5
Other	2.7
Total	94.7

Source: FAO, 1991.

149. Developed countries import close to 80 per cent of world imports for almost all the main products. For all products except non-coniferous sawlogs and veneer logs, non-coniferous sawnwood, veneer and plywood, the developed countries also provide over 90 per cent of world exports.

150. As well as dominating the export trade, developed countries are also the dominant importers of forest products, accounting for 85 per cent. Canada, for example, being the custodian of 10 per cent of the world's forests shares 21 per cent of the exports of forest products.

151. Regionally the largest exporters are Western Europe (45 per cent of world exports) and North America (33%). The main developing exporting region is the Far East (largely South-East Asia) which accounts for 10 per cent of world exports.

152. Only small volumes of coniferous logs or sawnwood, pulp, newsprint, and other paper and paperboard are exported by the developing countries. The main products exported are non-coniferous (tropical), with the main products being logs, sawnwood and plywood.

153. For timber and timber products, world trade is generally heavily dominated by a limited number of countries. Exports of sawlogs and veneer logs are dominated by the USA and Malaysia, sawnwood by Canada and to a lesser extent by the USSR, USA and Sweden, and solid-wood panels by Indonesia. Imports are less concentrated but still highly so, with Japan and the USA major buyers. Log imports are dominated by Japan and to a lesser extent the People's Republic of China and South Korea; sawnwood by imports into the USA from Canada, with smaller volumes into Japan, the UK, Italy and Germany; and panels by Canada (from the USA), the UK and Japan. Imports of panels are more evenly spread over a number of countries than is the situation for logs and sawnwood.

154. In the case of tropical timber and timber products, logs are imported by a number of countries, again with Japan the largest buyer. Sawnwood also goes to a large number of countries, while Japan and the USA are the main buyers of solid-wood panels. Malaysia (Sarawak and Sabah) is the largest exporter, Indonesia is biggest exporter for panels, and Malaysia and Indonesia account for a significant proportion of sawnwood exports.

Individual Products

155. An indication of the situation for the main product groups is given below:

(a) Roundwood

156. World production of roundwood reached 3,462 million m^3 in 1989. Of this, 24 per cent entered export trade in various product forms. For the developed countries, some 37 per cent of their production of 1,542 million m^3 was exported. This compares with developing countries' production of 1,920 million m^3, 80 per cent of which was consumed as fuelwood and only 6 per cent exported. Just under half of total world roundwood production was for industrial use, however, in tropical countries only 17 per cent of total production was for industrial uses.

157. Tropical roundwood production was 41 per cent of total world roundwood production, while tropical industrial wood production was 7 per cent of total world roundwood production and 14 per cent of world industrial roundwood production.

158. Although some exports of pulpwood occur, by far the dominant log flows are of sawlogs and veneer logs. Seven percent (70 million m^3) of the world production of 1 billion m^3 is exported in log form. Developing countries account for 40 per cent of these exports although they only account for 25 per cent of world production. Almost all developing country exports are from tropical countries.

159. Some 53 per cent of world sawlog and veneer log exports are coniferous and 47 per cent non-coniferous, with tropical logs representing 82 per cent of the non-coniferous logs.

160. The major exporters of coniferous logs are the USA, USSR, Canada, New Zealand and Germany, with the USA alone accounting for over half of all exports. In the case of tropical logs, exports are dominated by Malaysia (Sabah and Sarawak) (21 million m^3). The next most important exporters are Papua New Guinea (1.3 million m^3), Gabon (0.9 million m^3), Liberia (0.7 million m^3), Côte d'Ivoire (0.6 million m^3), Cameroon (0.5 million m^3) and Congo (0.4 million m^3).

161. Tropical logs make up 16 per cent of world saw and veneer log production, and 17 per cent of this is exported. By volume, 60 per cent of exports go to developed countries. In value terms tropical logs account for about one third of developing country log exports ($2.3 billion), the export from all developing countries being $2.4 billion.

(b) Sawnwood

162. Coniferous sawnwood exports are almost five times larger than non-coniferous with Canada dominating the former, followed well behind by the USSR, USA, Sweden, Finland and Austria. For non-coniferous (largely tropical) the dominant exporters are Malaysia, Indonesia, Singapore (an in-transit processing centre) and the USA (temperate hardwoods).

163. Tropical sawnwood provides most of the sawnwood exports of the developing countries. Production in 1989 was 12 per cent of total world sawnwood production, and 18 per cent (11 million m^3) was exported. Forty-seven percent went to developed countries. By value $2.8 billion was exported, 16 per cent of world export values.

164. The main importers of coniferous sawnwood are the UK, Japan, Italy, Germany and the Netherlands; of non-coniferous they are Japan, Singapore (for re-export), Thailand, Italy and the Netherlands.

(c) Wood Panels

165. Plywood and particleboard are the main panels entering world trade. Together they represent 76 per cent of the world total. Tropical plywood constitutes one third of world panel production, and of this two thirds (11 million m^3) is exported. In value terms this represents 58 per cent of world panel exports, totalling $3.9 billion. Exports are dominated by Indonesia (50 per cent of all exports), followed by Singapore (a re-processing centre), Malaysia and China (Province of Taiwan) (again largely a re-processing centre), the Philippines, Brazil and South Korea.

166. Just over half of exports go to developed countries. The main markets are the USA, UK, Japan, Hong Kong, Singapore, People's Republic of China, the Middle East, and a number of Western European countries. Although Asia dominates the plywood trade, providing 70 per cent of exports, it provides little of the world's exports in other panels. For particleboard, Western Europe accounts for 72 per cent of the trade (both of exports and imports), reflecting the extensive trade that occurs within Europe.

(d) Wood Chips

167. World exports in 1989 reached 24 million m^3 with a value of $1 billion. Trade is dominated by exports from Australia, the USA, and rapidly growing exports of Chile. Exports are only of minor importance to most developing countries. Japan totally dominates imports, taking 80 per cent of the world total.

(e) Pulp:

168. Developing countries only produce 7 per cent of world pulp, with 40 per cent of this being by Brazil. In value terms exports totalled $705 million in 1989 with Brazil and Chile providing $ 561 million (75 per cent) of this - $298 million and $231 million respectively.

(f) Paper and Paper Board:

169. Of a world production of 213 million tonnes, developing countries produced 32 million tonnes (15 per cent). Exports by the developing countries (by value) totalled $2,085 million, 5 per cent of world exports. The main developing country exporters are Brazil ($684 million), People's Republic of China ($236 million), and South Korea ($306 million).

Trade by the Developing Countries

170. Important features of the trade by the developing countries are:

- the high proportion of unprocessed or semi-processed products exported (i.e. logs, sawntimber and plywood).

- the importance of forest products to many countries as (a) earners of foreign exchange, (b) contribution to GNP and (c) a source of employment.

- an increasing desire by the developing countries to carry out more processing in their own countries.

- the difficulty of moving in this direction, particularly for the smaller countries (problems of meeting quality requirements, shipping, product standards, regular delivery, etc.).

- increasing trade barriers as products become more processed (higher tariffs, product standards, quotas, etc.).

- expanding domestic markets which must compete for supplies with export markets.

- declining forest resources in many countries.

- increasing action by groups in developed countries for the tropical countries to reduce forest harvests for conservation reasons. These groups are proposing trade restrictions to control or stop imports either by direct government controls or by promoting consumer/trade boycotts.

- increasing competition on international markets from the developed countries, both from softwoods and temperate hardwoods.

SECTION VI

SOCIO-ECONOMIC IMPACT ON TIMBER EXPORTING COUNTRIES OF RESTRICTIONS AND BANS ON IMPORTS OF TIMBER AND TIMBER PRODUCTS

171. Restrictions and bans on the exploitation of selected forest resources exist all over the world at a national and international level. Earlier in history these have very often been based on restrictions imposed by the owner (government or private) or on tradition-based and management-based reasons

(protection of watersheds or sensitive areas). Grazing and exploitation of forest has more often than not been subject to regulatory mandates by local authorities.

172. Measures oriented towards controlling or restricting trade are labelled trade barriers and include a series of mechanisms such as law, policy or practice including special tariffs, quantitative restrictions on exports or imports, licensing requirements, minimum pricing regulations, embargoes, prior deposits, special standards, and customs and administrative entry procedures. Examples of these mechanisms affecting forest products can be found in developed as well as in developing countries.

173. In most cases, these measures are taken to protect local conditions such as employment or to increase added value to exports in the producing country or to favour locally produced goods in the importing country. Some of these regulations can, however, have their base on more global concerns such as the restrictions or bans derived, for example, from the Convention on International Trade of Endangered Species (CITES).

174. In some cases trade barriers can be oriented towards favouring a region or a range of products, and based on general policies of the country or group of countries establishing such regulations. For example, unprocessed logs cannot be exported from federal lands in the USA. In Canada, provincial laws prohibit the export of any logs that could be processed by domestic agents. For many years up to the early 1970s Chile did not allow the export of unprocessed logs, while subsequent reversal of this regulation accelerated the development of the forestry sector.

Trade Patterns for Tropical Forest Products

175. The impact of trade measures imposed by developed countries is closely linked to the extent to which exports to the developed countries are important to the tropical developing countries. As an indication of this, some of the main features of trade in tropical timber (logs, sawnwood, and wood-based panels) in 1989 are given below:

- Around 17 per cent of world tropical roundwood production is used for industrial uses, with 83 per cent being used for fuelwood and other non-industrial uses. Out of the total volume of 234 million m^3 of industrial roundwood produced in the tropical countries about 105 million m^3 roundwood equivalent (i.e. 45 per cent), is exported in round or product form, of which about 16 million m^3 is exported as pulp and paper.

- Regionally, exports of tropical wood products represent 4 per cent by value of total exports of all products in Asia, 3 per cent in Africa, and 1.5 per cent in Latin America.

- The main forest products traded by the tropical countries, by value, are in rank order: wood panels (predominantly solid-wood panels), industrial roundwood (saw and veneer logs, pulplogs and wood chips) and sawn timber.

- Asia is the dominant supply region accounting for about 74 per cent of the tropical forest product exports (by value). Africa accounts for 8 per cent, and Latin America 17 per cent.

- Japan is the major buyer of tropical wood traded internationally, with the EEC, USA and to a lesser extent Australia being the other main buyers, though significantly less important than Japan. Developing countries are also important markets for most tropical products and their market share has been expanding.

176. These brief features of trade indicate that while only a small proportion of the wood harvested in the tropical countries is used for industrial purposes, nearly half of the wood used industrially ends up in international trade. If only timber and timber products are considered, about one third enters international trade. Thus although only a small outlet in terms of the total tropical wood harvested, international trade is a significant outlet for wood being used industrially. About one third of the exports are in log form.

177. In terms of total harvest, and absolute volumes involved, international trade with the developed countries is not a major item for many tropical countries. Between 40 and 50 per cent of logs, sawnwood and plywood exports from the tropical developing countries are to developed countries.

178. However, the importance to individual tropical countries of trade with the developed countries, particularly in relation to their economies, is not reflected by the volumes involved or the proportion of their harvests entering this trade.

179. Even though a global position on this approach has not been developed, advocates for bans and restrictions base their positions on the effects of logging on forests and local populations. They underline the loss of biological diversity, the effects on soils, the disruption of local communities, and the benefits which would derive from the conservation of forests.

180. Opponents to the measures tend to highlight the revenues in local and hard currency resulting from logging and exporting of timber, the employment opportunities and the consequences of forest land being converted to other land uses if these restrictions do not allow the forest products to reach appropriate markets. Opponents also point out that logging activities are not the main cause of forest destruction, and that exports only account for a small proportion of total wood usage.

181. The local social, economic and environmental aspects are often being hidden when global and very often incomplete statistics which do not reflect complex local realities are used. It would appear that a broader approach oriented to promote better management and conservation of forests geared towards sustainable management may be more acceptable to all parties involved.

182. The wide range of mechanisms and their varied effects on different sectors of the economy and on the social structures makes it difficult to develop a more comprehensive view in the context of this report. Several organizations, among them, FAO, ITTO, and UNCTAD, have been studying the

different measures and their effects and it would be advisable to expand analysis to include coverage of the social effects. Furthermore, the result of the discussions on trade restrictions under GATT may have a significant effect on the approaches to be taken in the future.

Recent developments in bans and restrictions

183. During the last few years and based principally on the concern regarding the level of destruction and degradation of Tropical Forest ecosystems some interested groups, particularly in the NGO sector in developed countries have been advocating for a series of actions oriented towards promotion of sustainable management of forests, raising awareness both in consuming and producing countries, support for indigenous people, promoting the revision of lending policies by bilateral and multilateral organizations and the restriction or banning of imports of tropical forest products and timber in particular. In practice this has received some support and have led towards unilateral decisions taken at the level of councils, municipalities, unions or even at national level. Reportedly over 1800 municipalities in Germany, and many in the in the Netherlands, United Kingdom and Belgium, have decided to ban or reduce the use of tropical timber within their jurisdictions unless produced in sustainable operations. Many individual consumers are refusing to use tropical timber unless its sustainable production can be proved.

184. The Government of the Netherlands has proposed to the parliament a policy oriented towards restricting imports of tropical timber by 1995 to those originated solely from sustainably managed forests. Some similar trends are developing in Austria and Denmark. This kind of consumer reaction is also found in the United States of America among other developed countries. For example restrictions regarding use of official funds for programmes associated with commercial exploitation of tropical forests are being included in the USA in a Senate Appropriation Bill thus affecting some 100 million dollars for projects. The total effect of these measures is still difficult to assess but the current trend and proliferation could have a serious impact on tropical timber markets in consumer countries as well as in producing countries in the near future. As a reaction some timber importers federations have proposed putting an import levy to be used as incentives for plantations (United Kingdom, the Netherlands) or have developed their own codes of conduct (Germany, Sweden). Some timber traders are proposing certificates to guarantee the sustainable production of their products.

185. The ITTO has, in 1990, adopted "Guidelines for the Sustainable Management of Natural Tropical Forests" and, in its Action Plan, set the year 2000 as the target date by which all exports of tropical timber products should come from sustainably managed forests. In this connection, discussions are being held to articulate views on links between forests, environment and development needs as well as to elaborate policy options for achieving this goal by the target date of the year 2000.

186. So far however it would appear that no universally accepted definition of the concept of sustainable management of forest is in current use nor the methodologies for field action sufficiently developed or available to the forest manager, the concessionary or operator nor are there mechanisms to establish any mutually acceptable control mechanism.

SECTION VII

TECHNOLOGY TRANSFER

Forestry Research and Technology Transfer

187. There has never been so much discussion about forestry research as there is at the present time. This reflects in part world-wide concern for the precarious state of forests. There is indeed strong evidence that the institutional arrangements for forestry research particularly in the developing world are not satisfactory. In many countries they are non-existent, and in some others where they do exist, there is actually a decline in their capability to conduct relevant research and to provide expert advice to governments. Career incentives for researchers are generally lacking, and very able and dedicated forest scientists are often without the means to conduct research or even to maintain international contacts. One damaging consequence is the important drain of research capabilities from the developing to developed countries.

188. Strong national research organizations are a basic requirement for adaptation and utilization of results of international research such as that carried out by the International Agriculture Research (CGIAR) set. It is the responsibility of national research programmes to tailor technologies for more specific physical and socio-economic environments. This calls for enhancing the two-way flow of information between national and international researchers through scientific networks.

189. One of the most important problems likely to be encountered is the lack of a specialized, effective and properly resourced national research cadre. Furthermore, because of this situation, many countries have little memory of past national efforts in forest research and little knowledge of international progress in the subject. Thus, relevant research results from elsewhere cannot be easily adopted. These deficiencies constitute a major obstacle to the implementation of technology transfer. The International Union of Forest Research Organizations (IUFRO) has made strong efforts on forestry research, networking and exchange of information but resources available are still insufficient. International technical cooperation has not to date given a high priority to forest research needs. Only 5 per cent of total official development aid in forestry is earmarked to forestry research activities as against 10 per cent in the agricultural sector.

190. Increased priority must be given to the formulation and implementation of technical assistance projects for strengthening national research capabilities and supporting applied, site- specific, research. Existing mechanisms such as the Tropical Forestry Action Plan could be used to that effect. All these efforts must be complemented upstream by the international research programmes to be developed by the new forestry entity being established with the CGIAR.

191. There is a need for a two-way flow between national research and the forestry education institutions. When nations lack the capability to produce forestry specialist cadres, the forestry sector is not well managed and the forestry profession is not given its right status in society. Consolidation of national research institutions is basic for guaranteeing the flow of

scientific information necessary for higher forestry education to produce well-trained cadres. Research needs in forestry for individual developing nations cannot be adequately assessed in the absence of discussion and action in the field of forestry education and training and vice-versa.

Forestry extension and technology transfer

192. The extension programmes to communicate relevant forestry research information to the users have met with varying success. The development of adequate forestry development programmes is a vital condition for an effective technology transfer. Forestry extension has not always been closely linked to forestry research, and research programmes too frequently have been developed without a sufficient interaction with the end users, be they farmers, forest owners or forest entrepreneurs.

Forestry education training in relation with technology transfer

193. One of the main problems in forestry education and training in developing countries is the lack of career incentives and low salary situations for trainers. Forestry education institutions are therefore faced with continuing manpower problems. This situation leads to the proliferation of income-generating activities like specialized short courses and consultancy assignments, to the detriment of the quality of the education, and of time spent by trainers with their students.

194. The demands on the forestry profession at present are unprecedented and extraordinarily diverse. It is practically impossible to incorporate in the forestry curricula the many subjects that critics of the profession say should be taught to foresters. The response to contemporary demands therefore can be met only by the development of new, appropriate courses and postgraduate specializations rather than the incorporation of more and more material in the professional forestry degree.

195. The weakened condition of forestry education in developing countries is the key constraint in preparing research cadres for national research institutions. One of the typical symptoms is the use of foreign textbooks which are not suitable for national needs. Governments have been advised and in many cases supported in the development of graduate and postgraduate education centres. FAO, for instance, has been active in assisting countries in exchange of information on curricula and on innovations intended to adapt education and training to forestry's changing needs, and Unesco's MAB programme has been particularly active in organizing research and training programmes on tropical forests.

Education and training and Women's Roles

196. The pervasive neglect of the role of women in development planning and policies has affected technology transfer in several nations. Methods to promote the greater involvement of women in forestry technology development and transfer are needed. Training and extension programmes must be carefully reviewed and appropriately modified to take into account the role of women in forestry and their related needs.

Forestry education on the technical side

197. One of the constraints in technology transfer is related to the inadequate development of technical and vocational forestry education. International agencies have repeatedly encouraged developing nations to attend to the needs of technical and vocational education. Many managers in private and public enterprises still think of money spent on training the workforce as a cost rather than an investment. The training of forest technicians and workers is a key element in any strategy to reduce the cost associated with the present levels of waste, equipment down-time and breakage, under-utilized processing capacity and environmental damage caused by forest operations. If managers cannot rely on a qualified workforce to carry out logging and tending operations in accordance with the silvicultural prescriptions, there cannot be sustainable management.

198. More forestry schools at the technical and vocational levels could be established including the creation of staff training centres. An interesting development during the last decade has been the expansion by some developed countries of their technical training facilities for overseas students. However, the enormous difference in cultural, social and economic structures and attitudes coupled with the biological and ecological differences should be carefully considered. Forest research and training developed in the developed countries, located in the temperate and boreal regions, need to be adequately "translated" and in many cases "simplified" to respond to the developing countries' needs.

SECTION VIII

INTERNATIONAL ECONOMIC ENVIRONMENT AND POVERTY

199. It is now widely recognized that humankind is dependent on forests and land-based resources for a multitude of goods and services which support life itself. It is also widely realized that forest resources, like many dimensions of the environment, are being rapidly depleted, degraded, and over-exploited throughout the world, in both temperate and tropical zones. The causes and the consequences of environmental degradation are complex and manifold. The manner in which forest resources are managed is closely interlinked with development patterns, poverty, and international economic forces. Thus, identifying the reasons and potential solutions for degradation requires an understanding of the nexus between social, economic, and ecological parameters.

The Vicious Circles: Interconnected Consequences and Causes

200. Deforestation not only has negative physical effects such as loss of biodiversity and disruption of climate, but it also has an impact on the living conditions of living in the area. For example, in many parts of the world, forests are frequently converted to cropland or pastures in fragile or steeply-sloped areas where such productive activities cannot be sustained. This usually leads to serious soil erosion and land degradation; and this, in turn, contributes to declining productivity and impoverishment of millions of rural poor people. In addition, dwindling firewood supplies add to the difficult survival burden for millions of rural poor people, especially for

women who must travel increasing distances to obtain firewood (along with water) for their families. Furthermore, deforestation in tropical countries usually occurs as part of land-ownership concentration and/or frontier expansion, which has often displaced indigenous forest dwellers, erode valuable cultural diversity and knowledge, and marginalized or "squeezed out" rural small farmers.

201. Thus, poverty is both a cause and a consequence of the degradation of forests and other natural resources. "Poverty and deforestation are locked in a vicious circle of mutual reinforcement" (Tangpan et al). This relationship is being increasingly acknowledge by environment/development analysts. For example, it is known that the poor, especially small farmers or colonists who migrate into frontier marginal forested areas, contribute to the cutting and burning of trees in order to plant crops or grass cattle. However, this does not mean that the poor should be "blamed" or disparaged. Many of them "exploit" these resources and/or live in deteriorated physical environments due to economic pressures outside of their control and lack of alternative sources of income. In other words, poor people deforest frontier areas of steep land for their rational survival needs. The land and resources provide them means of satisfying immediate needs. Their planning horizon is short by necessity. The tragedy is that the land in marginal or fragile areas usually cannot sustain production over time, and yields decline, and consequently these families become more impoverished - generally unable to afford inputs which could help offset losses. In response, they sometimes must abandon their land and migrate. Another survival strategy of the poor is to have more children, who can assist with farm labour and add to the family income. Yet, ironically, in many cases the added numbers contribute to pressures on resource base. Thus, people are often "trapped" into a vicious circle, as victims of land-use change and unsustainable development.

202. We clearly see that the explanation of resource degradation must encompass deeper causes beyond "poverty" itself; there are other important "actors" and critical social and economic causal forces behind this. First of all, it must be understood that poverty is derived from (and interrelated with) deeply-rooted historical development patterns, economic pressures, and inequities. In fact, another central cause in the deforestation process is the "the flip-side" of poverty - i.e., "over-consumption" and exploitation by very wealthy actors, including logging companies, cattle-ranchers, and land-speculators. The practices of these influential actors, such as consolidation of property, land speculation, and clear-cut unmanaged exploitation of forests, contribute to socio-economic stratification, displacement and pressures on the poor.

The Economic Environment and its Relation to Poverty and the Environment

203. Economic policies which underlie these prevailing development patterns are equally important "root causes" which contribute directly to the expansion of the marginal forested frontier and consequent degradation. Commonly-found examples of these policies are:

- agricultural development and colonization policies, which induce people to "improve" land through tree-clearing in order to gain title;

- land-use development and tenure policies which institutionalize concentration of land, and/or marginalize or harm indigenous forest-dwellers;

- subsidies to cattle-ranching and timber industries;

- credit policies which favour large landholders and facilitate the buying out of small farmers;

- tax incentives for land development, which leads to land-concentration and cattle expansion;

- undervaluation of forest resources and underdeveloped markets for timber;

- inappropriate incentives for timber concession, that thwart sustained management;

- logging restrictions or stumpage fee policies which are inefficient and counter-productive;

- patterns of commodity trade which place pressure on prices of third world exports;

- incentives to open up new frontiers, serving as "escape valves" for poor people and to avoid confronting the deeper causes of poverty and social-stratification;

- incentives to private sector for maximization of present yields and resource exploitation (often for exports markets), often aimed for servicing external debts.

204. Although these kinds of policies have been designed with positive intentions, generally for economic growth objectives, they have in many cases provoked and exacerbated pressures on resources. Some analysts have called these "perverse" or distorted incentives due to their adverse environmental impacts and their simultaneous negative social harm to poor segments of society. Such incentives are generally backed by strong group interest and various forms are found throughout the world. They can create an economic climate that will not necessarily help inducing sustainable and equitable development patterns.

205. It is important to understand that the national-level economic policies are inextricably linked to and shaped by the prevailing international economic policies. Although many benefits and positive outcomes have been generated by present the patterns of development have also contributed to unsustainable resource use in many cases, and the benefits often have not "trickled down" as hoped. Furthermore, in recent years, the terms of international trade and the problem of external debt burdens faced by many developing countries greatly influence both the land use dynamics at the agriculture/forestry frontier and the national policies which seek to mediate them. Many of the proprietors of tropical forests are also heavily indebted developing nations. Most of them rely on exports of resource-based primary commodities to fuel their

economies. With the drop in world prices for these materials in recent years, exporting countries have been under pressure to rapidly exploit many of their natural resources, and in the process degrade the environmental support systems. Competition among developing countries for share of industrialized markets, as well as technological advances in substitute products, have resulted in inflated commodity supply and have added pressure on prices and on resource.

206. For small poor farmers or landless labourers in developing countries, this broad economic environment translates into strong pressure to convert their diverse farming systems to commercial monocultural agroexport production, to move into frontier areas and exploit resources at an increasingly intense rate, and to compete effectively in the international market. Such activities or investments may offer a source of income - at least temporarily. However, the conversion to monocultures often creates vulnerability to fluctuating international market prices, and replaces traditional farming and agroforestry systems which were previously more sustainable. Moreover, typically, small farmers are again burdened by rising and unaffordable costs of agrochemical inputs, declining yields from unfertile soils, inaccessibility to markets, and declining sources of fuel and food. Thus, this model usually does not offer an enduring respite from poverty. If they cannot compete or hold on to land in the first place, given inadequate titling laws and pressures from large investors, they are squeezed out or left in bankruptcy.

207. These concerns do not mean that expanded commerce, investment and trade are necessarily detrimental ecologically and socially. On the contrary, many benefits can be attained through the expansion of sound private investments in conservation and sustainable development activities. Yet, past patterns have often been driven by short-term interests and irrational management, which inevitably perpetuate a vicious cycle. Although many of the issues surrounding international trade/economic policies have complex and indirect linkages to socio- economic and environmental conditions, these linkages are attracting increasing attention and deserve more consideration. Policy officials and local-level organizations have expressed interest in preventing potential human/ecological degradation and creating an economic environment that will build sustainable development opportunities.

208. Escaping from this downward spiral of degradation and poverty requires a multi-faceted and integrate approach. In other words, a successful way to achieve sustainable development of forests resources must incorporate economic, social, and ecological considerations. Projects and policies aimed for the management of forests and the control over deforestation must be accompanied by transformations and actions to improve the security of livelihoods, overcome resource inequities, and alleviate rural poverty. There are opportunities to link forest conservation and people-centered development. The technologies and methods generally exist for forest management, extractive reserves, reforestation, agroforestry, and other sustainable systems. Effective techniques are often derived partly from traditional practices of indigenous forest dwellers. Moreover, increasing numbers of private and public entities are finding opportunities and ways to profit through the rational management of forest and land resources - which can benefit all sectors of society. However, the social and institutional

challenges remain to overcome economic and institutional barriers, to ensure that the poor can adopt and benefit from these methods, and to generate economic incentives and policies that will support sustained and equitable development patterns.

209. It has become clear that actions/changes must address the root causes of human and resource degradation, especially the economic forces which contribute to deforestation, displacement, and impoverishment. If countries confront these roots, rather than treating the symptoms, they are more likely to encourage people to pursue long-term sustainable resource use and to simultaneously alleviate poverty. This challenge requires major changes such as:

(a) eliminating policies which presently perpetuate the spiral of deterioration; and creating economic policies (in both North and South) that encourage sustainable resource management;

(b) ensuring more equity in the distribution of resources, and security of tenure, enabling poor people to have greater livelihood security and economically- empowering opportunities (through, for example, changes in land titling and tenure systems, improving access to markets for forest-based products and crops, securing the claims of forest-dwelling peoples to their traditional lands, building opportunities for the disadvantaged, especially women and indigenous peoples, to benefit from forest/resource management, such as social forestry and small forest industries);

(c) strengthening institutions at all levels for sustainable forest and resource management, including regional and international organizations which can help improve environmental and economic regulations, national government agencies, non-government organizations and "grassroots" groups, involving active participation and training with local communities;

(d) increasing the role of the private sector in sustainable forest production, agroforestry, and other natural resource management activities;

(e) stemming population pressures on the "frontiers", through a combination of demographic planning/policies and education efforts, and economic policies to alleviate poverty.

210. These and other changes need to be developed and adapted to local circumstances. Some countries have already begun to take these kinds of fruitful initiatives. Nevertheless, a great deal of work remains to improve understanding of these complex linkages and to address them effectively, to overcome environmental degradation, injustices, and poverty.

SECTION IX

INITIATIVES RELATED TO MANAGEMENT, CONSERVATION AND SUSTAINABLE DEVELOPMENT OF FORESTS

Introduction

211. This part of the report concentrates on the recent major issues related to the present and future situation of forests and forestry under consideration in the international organizations more directly concerned with forestry.

Food and Agriculture Organization (FAO)

212. Forestry was introduced into FAO in 1946, one year after its foundation, and in 1970 the Forestry Division was upgraded into a full technical Department. FAO is the United Nations specialized agency responsible for the collection, analysis and dissemination of information on all aspects of forestry and primary forest products and the principal multilateral agency for technical assistance in forestry to the developing countries playing an important role in stimulating forest and tree based development.

213. The 158 FAO member countries govern the activities of the Organization through the Conference and Council, which receive advice on forestry matters from its Committee on Forestry (COFO). This body deals with the whole array of forest matters worldwide and it conducts periodic reviews of international forestry problems and proposes coordinated actions for their resolution. The Committee on Forest Development in the Tropics (CFDT) with a membership of tropical as well as other countries, studies technical, economic and social issues relating to the development of tropical forests, having regard to production, utilization and conservation aspects. It also reviews international programmes in tropical forestry in order to study and report on the harmonization of such programmes and the concerted actions that governments and international organizations could take to ensure rational tropical forest development and utilization.

214. Six regional forestry commissions - for Africa, Asia, Europe, Latin America and the Caribbean, Near East and North America - and the Committee on the Mediterranean Forestry Questions - Silva Mediterranea - advise on the formulation of forest policy and coordinate its implementation at the regional level. In addition, five other technical bodies and expert panels, as well as subsidiary bodies of the regional forestry commissions advise in specific subject matters at global or regional levels, in such fields as education, research, forest genetic resources, wildlife, panel products and pulp paper.

215. The Forestry Department collates data relevant to forests and forestry from every part of the world which is analysed, processed and summarized in such publications as the Yearbook of Forests Products, UNASYLVA, monthly bulletins, and technical and economic reviews. The technical staff (75 professional positions mostly at HQ and some in FAO regional offices and joint divisions with other agencies) also provides technical advice through preparation of status reports and manuals, sector studies, field project

development and technical backstopping. FAO also organizes, jointly with host countries the World Forestry Congresses, the 10th of which is to be held in Paris in September 1991.

216. The FAO Forestry Department provides technical assistance through implementation of projects financed by bilateral and multilateral sources. The present programme involves some 320 projects in 90 countries and the engagement of 690 FAO staff (including consultants) and at an estimated disbursement in 1991 of $US 68 million. The current total value of the approved field programme is $US 353 million.

The Tropical Forestry Action Plan (TFAP)

217. In the early 1980s, FAO and UNEP produced a comprehensive assessment of tropical forests which constituted the basis for an official alarm regarding deforestation in tropical countries. Concerned with the rate of destruction of tropical forests and its consequences, but at the same time recognizing the potential of those forests to contribute to socio-economic development, FAO at the request of the CFDT, together with the World Bank, UNDP and WRI, launched the Tropical Forestry Action Plan in June 1985. The Plan was subsequently endorsed by a number of international meetings including the 9th World Forestry Congress and the FAO Conference (Rome, November 1985). The Plan provides a framework for actions at national, regional and global levels in tropical forestry. The Plan has received strong support from multilateral and bilateral assistance organizations. During the past 6 years, 86 countries representing around 93 per cent of the tropical forest area (Brazil excluded), have joined the TFAP process, with only 15 such countries still to join. However, criticism has also been voiced, particularly from non-governmental organizations who perceive that insufficient attention has been given to environmental issues such as climate change and biodiversity, involvement of local and indigenous communities and effective cross-sectoral approaches. In order to assess the situation, FAO appointed an Independent Review Team, which in its report confirmed some of these problems and suggested several measures for its re-orientation. The Independent Review proposed among other measures to make TFAP more country-driven and process-oriented. It also recommended to initiate the preparation of an international convention on the conservation and development of the world's forests.

218. The FAO Committee on Forestry, in September 1990, recommended to increase the efficiency of the TFAP, particularly through strengthening national capabilities. It also dealt with the concept of an international instrument on the conservation and development of forests. The Committee further agreed that FAO continue its efforts to contribute to the preparation of the legal and technical scope and content of such an instrument in close collaboration with the UNCED Secretariat and international organizations concerned.

219. The FAO Council, in November 1990, endorsed the concept of an international instrument on the conservation and development of forests and requested that this issue be referred to its next session in June 1991 for further consideration of action to be taken in the light of developments in other international fora.

220. FAO informed the Council in June 1991, on the different developments on these subjects and particularly on the decisions taken at the second session of the UNCED Preparatory Committee. The Council noted the report made by FAO and instructed FAO to continue collaborating with the UNCED. The Council further recognized the usefulness of a comprehensive international consensus on the management, conservation and development of all forests.

The International Tropical Timber Organization (ITTO)

221. The ITTO was established by the International Tropical Timber Agreement, 1983, under the auspices of the United Nations Conference on Trade and Development (UNCTAD). Although established by the United Nations, the ITTO is an intergovernmental organization outside the United Nations system. Members consist of 22 developing producing countries having sovereignty over 70 per cent of the global tropical forests, and 24 mainly developed consuming countries (Egypt being the sole developing country in the consumers group). The International Tropical Timber Agreement (ITTA) is the only existing agreement on the tropical forests although the commodity aspect is its main theme. Because the Agreement gave prominence to the environmental aspects of the need to maintain the ecological balance and to encourage the development of national policies aimed at sustainable utilization and conservation of tropical forests for timber production, the ITTO is perceived as an organization which could play a further significant and effective role in the promotion of sustainable development of the tropical forests. This role is borne out by the development and evolution of the ratios between its projects in the three main divisions of its objectives: thus 70 per cent of its projects are in the field of reforestation and forest development, 20 per cent in that of forest industry and 10 per cent in the field of economic information and market intelligence. Its published guidelines on sustainable management of the tropical forests for timber production serves to fill a well known need and may possibly have the effect of extending the establishment of sustainable development in many tropical forest countries.

222. The ITTO is an institution dealing with tropical forest matters not limited to the commodity aspects. It has three Permanent Committees in which technical details are worked out on project appraisal and assessment, while policies of political significance are dealt with in the Council consisting of all member countries, namely, the developing countries with the resources, and the developed countries, which are the potential donors to help implement, inter alia, its sustainable management projects. The ITTA could be a useful example to consider in the institutional aspects relating to the utilization, care and protection of the world's tropical forests. The ITTA is due to be renegotiated by 1994 at the latest, when it is thought that the original agreement might be modified to better serve the ITTO's evolutionary development and the tropical forests as well, in close cooperation with existing agencies in this field.

223. The ITTO Council (Quito, Ecuador, June 1991), recently decided to convene a workshop to identify options for the formulation of trade policy based on concrete principles, promoting sustainable development of tropical forests

Climate Conference

224. In the context of the 1990 Second World Climate Conferente the Ministers declared that they recognized that forests and forest products play a key social and economic role in many nations and communities. They also recognized the sovereign right of States to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

225. They also noted that the conservation of the world's forests in their role as reservoirs of carbon, along with other measures, are of considerable importance for global climate stability, keeping in mind the important role of forests in the conservation of biological diversity and the protection of soil stability and of the hydrological system. They further recognized the need to reduce the rate of deforestation in accordance with the objective of sustained yield development and to enhance the potential of the world's forests through improved management of existing forests and through rigorous programmes of reforestation and afforestation. They also recommended that the protection and management of boreal, temperate, sub-tropical and tropical ecosystems be well coordinated and preferably compatible with other possible types of action related to reduction of emission of greenhouse gases, rational utilization of biological diversity, provision of financial resources and the need for more favourable market conditions for timber and timber products. The developing countries should, they declared, be able to realize increased revenue from these forests and forests products.

Forest Research

226. Research in the forest sector has been developed in national institutions in developed and developing countries as well as in some regional and international organizations such as FAO, UNESCO, IUFRO, ITTO, UNRISD, IUCN and others. However, during the late 1980s, it was felt necessary to increase the level of action and funding to further support forest related research worldwide.

227. Several recommendations were made in this sense at the Bellagio meeting on Forest Research which were then proposed to be considered within the context of the Consultative Group on International Agricultural Research (CGIAR).

228. General support for the incorporation of Forestry into the CGIAR system was then given at the International Centres Week, held in Washington, D.C. (October/November 1989 - ICW/89). Following a series of meetings in Rome, in March 1990 the Technical Advisory Committee (TAC) put forward a suggested institutional approach to the incorporation of forestry and agro-forestry into the CGIAR system.

229. A working group of five representatives of donor governments and agencies was formed by the CGIAR to examine the implications of the decisions taken and to report to the mid-term meeting of the CGIAR in May 1991. The CGIAR has now decided to include the International Council for Agroforestry Research (ICRAF)

based in Nairobi, Kenya as the anchor for agroforestry research, and to establish a new Service called International Service for Research on Forestry (ISREF). While further decisions are taken in respect of ISREF regarding its possible board, an outline programme and a mode of operation, ICRAF is to be brought immediately into de CGIAR and begin its interaction with the Technical Advisory Committee on an interim budget, its interim Strategic Plan and to make satisfactory arrangements for collaborative linkages with ISREF and other CGIAR activities.

230. It may be noted however that although these developments will constitute a major step in increasing efforts for forestry research they will not necessarily respond to all the current needs the developing countries may have in this sector. Developing countries will still need to develop forest research for their own local needs and identify, from research developed in other countries, results which may be suitable for solving several of their problems.

European Community

231. The EC action in the forest sector focus on three main elements: Improvement of forest productivity and development of silviculture in rural areas; increase in forest areas and protection of forest patrimony.

232. The EC has established a Permanent Forestry Committee to articulate forest objectives within Community policies and co-ordinate forest policies of the member States. Within this context the EC has initiate the development of several programmes related to protection of forests against air pollution; assessment of forest damage; protection of forests against fires; forest research programmes, etc., as well as develop policies for action outside the Community as for example the policies derived from the Lomé IV convention and technical assistance and development projects in selected areas.

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Land Resources: Deforestation

Conservation and Development of Forests

Guiding Principles for a Consensus on Forests

Report of the Secretary General of the Conference

INTRODUCTION

At the second session of the Preparatory Committee for the United Nations Conference on Environment and Development the Secretary-General of the Conference was requested 1/ to re-examine its work on document A/CONF.151/PC/27, in line with decision 1/14 of the first session of the Preparatory Committee, taking into consideration the various submissions made during the meetings of Working Group I and the Ad Hoc Subgroup on Forests, and as fully and as comprehensively as possible to analyse and address various elements related to forests.

1/ Doc: A/46/48 (Part I) Decision 2/13.

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It further requested the Secretary-General of the Conference to take due account in its further work in this area of the relevant paragraphs of the Bergen Declaration, the Tlatelolco Platform on Environment and Development and the Final Declaration adopted by the Ministerial Conference on Environment and Development for Asia and the Pacific, as well as the results of the Regional Conference for Africa, organized in accordance with section II, paragraph 13, of General Assembly resolution 44/228 of 22 December 1989 and decision I of the Preparatory Committee at its organizational session.

The Preparatory Committee outlined, inter-alia, seven principles for the further consideration at its third session leading to the United Nations Conference on Environment and Development.

The Preparatory Committee also expressed that upon thorough assessment of the additional information to be presented by the Secretary-General of the Conference to its third session, Working Group I would be in a position to examine all steps towards and options (including, at least, taking into account the special situation and needs of developing countries, a non-legally binding authoritative statement of principles) for a global consensus on the management, conservation and development of all types of forests, either as a part of the proposed Earth charter or separately, while noting that the completion of this work may best be decided at the United Nations Conference on Environment and Development in 1992.

Finally, the Preparatory Committee affirmed that the United Nations Conference on Environment and Development process was the most appropriate forum for conclusive decisions pertaining to global consensus on forests.

Drawing on the documents and decisions mentioned above as well as on the support of the members of the Working Party on Forest and the collaboration of several governmental and non-governmental organizations such as FAO, the WRI, ITTO, IUCN, UNESCO, the Secretary-General of the Conference presents a list of basic principles to be considered by the Preparatory Committee, at its third session in their deliberations related to an eventual consensus on forests.

Guiding Principles for a Consensus on Forests

These deliberations call for the attention of all developed and developing countries, benefiting from forest resources of their own and from those located in other regions of the world. as well as those from regions with little forest resources but which need to recover or establish trees and forests for the improvement of the quality of life of their people.

A global consensus on forests could take into consideration the following basic principles:

1. Global coverage

It should apply to all existing forests: austral, boreal, temperate, sub-tropical and tropical as well as to areas susceptible to be covered by forests.

2. Reaffirm sovereignty

It should reaffirm Principle 21 of the Stockholm Declaration (1972).

> Principle 21 reads: "States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction."

3. Affirm stewardship

It could assert the need for stewardship of forest resources and forest lands in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations.

4. Recognize common responsibility

It could provide for equitable sharing by the international community of the burden of forest conservation and development.

5. Promote integration

It could promote full integration of all aspects of environmental protection and social and economic development as they relate to forests and forest lands.

6. Strengthen framework for national efforts

It could provide a framework for increased national efforts including the development and strengthening of national policies, programmes and institutions for conservation and sustainable development of forests and forest lands.

7. Ensure sustainable management

It could promote and ensure the sustainable management of forests to meet present and future social, economic and cultural human needs such as for wood and wood products, food, fodder, medicine, fuel, shelter, recreation and landscape diversity while protecting forests against harmful effects of air pollution, fires, pests and diseases.

8. Recognize role of forests in climate

It could deal with the maintenance, restoration and enhancement of the ability of forests to act as sinks and reservoirs for carbon and other greenhouse gases known to affect the world's atmosphere and with the reduction of the contribution of deforestation and forest degradation to the accumulation of greenhouse gases in the atmosphere.

9. Recognize the role of forest in maintaining biological diversity

It could provide for the conservation, maintenance, restoration and enhancement of the biological diversity of forested ecosystems, including genes, and species, in particular emphasizing the need to identify and protect selected areas of natural forest ecosystems (including old-growth forests) and the need to document where lacking, the biological resources of forests.

10. Underline the role of forests in soil and water conservation

It could recognize the vital role of forests in protecting highlands and mountain areas, watersheds and freshwater resources, for example in reducing floods and soil erosion, and maintaining the water cycles as a sustainable source of hydroelectric energy and for irrigation and urban use.

11. Deal with fuelwood and energy

It could endeavour to meet the demands for fuelwood for household and industrial needs in ways that avoid deforestation and degradation of forests.

12. Encourage reforestation and rehabilitation

It could provide for the maintenance and increase, in ecologically and socially sound ways, the total area and productivity of forests. It could address the rehabilitation and reforestation and, more generally, the reestablishment of trees and forests on unproductive, degraded and deforested lands.

13. Ascertain the recognition of forest dwellers, local communities and indigenous peoples rights

It could respect the rights and interests of forest dwellers, local peoples and indigenous communities who rely on forests to maintain their livelihood, social organization and/or cultural identity.

14. Consider the role of women

It could stress the vital role of women for the conservation and sustainable development of forests.

15. Promote Research and monitoring

It could encourage the revision, application and where appropriate the expansion of existing knowledge through research, inventory and monitoring on the biological, physical, social and economic components of forest resources and forest ecosystems and of the various uses of and threats to forests.

16. Develop and strengthen education and training

It could strengthen institutional capabilities in education and training, improve education in the science, technology, economics and social aspects of forests and forest management.

17. Guarantee access to information

It could provide guarantees for the full and open access to information and the decision-making process related to sustainable forest management.

18. Promote economic and trade policies

It could integrate forest conservation and sustainable development policies with economic and trade policies, eliminate, wherever practicable, subsidies and other governmental interventions which encourage deforestation and unsound forest practices and facilitate orderly and free international trade in forest products from sustainably managed forest resources.

19. Provide framework for international assistance

It could ensure a vital increase in international cooperation for policies and programmes aimed at forest conservation and sustainable development. Provide financial and technical assistance to help countries implement national, regional and international policies and programmes aimed at the conservation and sustainable development of forests.

It could consider the establishment of special funding arrangements to support sustainable management as well as the expansion of forests and other forms of vegetation cover.

20. Develop international institutional arrangements

It could provide for appropriate international institutional arrangements, taking into account those organizations and mechanisms already in existence, for the attainment of the objectives of the global consensus, including mechanism to monitor its implementation, to assess progress and to coordinate international action.

21. Ensure linkages with other instruments

It could complement and be coordinated with other international initiatives with implications for aspects of forestry, notably the climate change and biodiversity conventions and with existing conventions or treaties.

The above set of principles which has been developed on the basis of the deliberations of the second session of the Preparatory Committee are submitted to the third session for its consideration. The Preparatory Committee may wish, on the basis of these principles, to further examine steps towards a global consensus on the development, management and conservation of forests and forests lands.

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CONSERVATION OF BIOLOGICAL DIVERSITY

BACKGROUND AND ISSUES

Report of the Secretary-General of the Conference

INTRODUCTION

1. At its second substantive session, the Preparatory Committee requested the Secretary-General of the Conference to take due account of decision 2/9 and to elaborate on the conservation of biological diversity for discussion at the third session. The UNCED secretariat acknowledges the contributions from the Working Party on Biodiversity which met in Rome, 29 and 30 April, 1991, as well as inputs received from other experts in preparing and reviewing this report.

2. The Secretariat has given careful consideration to the relevant passages of the regional declarations in developing "Options for Agenda 21" for the "Conservation of Biological Diversity" as outlined in document A/Conf.151/PC/42/Add.4. These options address the need to ascertain the full extent of the earth's biological diversity (biodiversity) in a concerted and

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systematic way; the need to develop economic and other techniques for integrating biodiversity concerns fully into the decision-making process at all levels; the need to strengthen new approaches for conserving biodiversity; and the need to improve awareness-raising, education and training and to provide for building up institutional capacities, especially in the developing countries.

3. Following decision 16/42 of the Governing Council of UNEP at its sixteenth session (May, 1991), the "Intergovernmental Negotiating Committee for a Convention on Biological Diversity" met in Madrid 24 June to 3 July 1991. The meeting considered a revised draft of the Convention, prepared following the Ad Hoc Working Group of Legal and Technical Experts in Nairobi 25 February to 6 March 1991. The draft was based, inter alia, on the discussions of a regionally balanced group of senior legal advisors who were present at the second session and who met in Geneva from 11 to 13 April 1991.

4. As stated in paragraph 2 above, this report also takes account of the relevant paragraphs of the Bergen Ministerial Declaration on Sustainable Development, the Tlatelolco Platform on Environment and Development, the Ministerial Declaration on Environmentally Sound and Sustainable Development in Asia and the Pacific, as well as the results of the Regional Conference for Africa.

STATE OF KNOWLEDGE ON BIODIVERSITY

5. The rich diversity of genes, species, populations, and ecosystems on our planet provides an abundant and essential supply of indispensable goods and services. They constitute the basis of our sustenance, providing all our food and fiber needs, and many of our medicines. Some of this biodiversity grows in farmers' fields, most of the rest is found in forests, savannahs, deserts, tundras, and the seas. A small amount is in genebanks, botanical gardens, and zoos.

6. Diversity is constantly changing. New genes arise out of mutation, and old ones are eliminated by selection. New species arise by the normal processes of evolution, and old ones go extinct for a variety of reasons. Farmers and breeders develop new crops, and give up growing old ones. Lately, human activities have increased significantly the rate of loss of biodiversity, but not much has been done, or can be done, to increase the rate of generation of new diversity. The result is loss of biodiversity. By losing biodiversity, we lose options for future development, especially of new and more productive food crops and medicines.

7. Micro-organisms and animal wildlife are a crucial component of biodiversity, especially invertebrates. They play an essential role in natural ecosystems, helping in the circulation of nutrients, and effecting their decomposition and mineralization. Birds and insects play an irreplaceable role in the pollination of plants; many birds and mammals play a similar role in seed dispersal. Hunting wild biomass, especially of vertebrates, has provided the genetic stock for our domesticated animals. Skins, hair, feathers, tusks, horns, and other wild animal products are a major source of income for people in many countries. Finally, plant and animal diversity is a major attraction for tourism.

8. The natural ecosystems all over the world have been transformed by humans at increasing rates since the invention of agriculture 10,000 years ago. The rate of transformation has been particularly intense since the industrial revolution and the rapid rate of growth of the human population that followed. Ecosystem transformation carries with it the threat of a potential loss of biodiversity, although the precise relation between landscape transformation and biodiversity loss is unknown. Although it is not known what the exact negative consequences of losing biodiversity are, there is apprehension that the consequences of biodiversity loss may be grave. The loss of genes and species can not be recovered.

9. Population pressures will continue to exert important impacts on the diversity of biological resources. The increasing demand for basic needs requires a more efficient and effective use of our environments. As a result, more untouched ecosystems will be used to address these needs, either at sustainable levels or at over-exploitative levels. Biodiversity may therefore diminish. The challenge is to find ways to permit development of natural resources without threatening their integrity and diversity excessively. For that we must first learn how much biodiversity is present, what its role is in the function of species, populations, and ecosystems, and what its potential economic value is. Ways must be developed to preserve biodiversity while permitting agricultural, forestry, and fisheries development. Since the rate of transformation is rapid, and the potential loss of biodiversity is high, time is of the essence.

10. There is much scientific uncertainty regarding the number of species which inhabit the earth. The information is quite accurate for certain groups (ie. vertebrates, especially mammals and birds) and very poor for others (ie. nematodes and viruses). Knowledge of the genetic diversity of wild species, including that of relatives of economically important plants is even poorer. One serious problem is the lack of knowledge regarding the total number of species. It has been suggested that there may be as many as 100 million life forms on the earth, ranging from the largest mammals to the tiniest micro-organisms. The scientific consensus is that the actual number is of the order of 10 million. 1/ So far, approximately 1.4 million species of plants, animals, and micro-organisms have been described. However, many new species are discovered and described daily, so this figure is an underestimation. The geographical distribution of biodiversity is uneven, with about two-thirds of all terrestrial species being found ~~in the tropics~~. 2/

11. Wet ecosystems, especially tropical forests, harbor many more species than dry and cold areas, but that is not to say that they are any less important. In spite of being in the temperate zone and having a pronounced dry season, Mediterranean-type ecosystems are among the most diverse in the world. Temperate regions, especially in the northern hemisphere, are much better studied than tropical regions, but major gaps remain in existing capacities for measuring, recording, and monitoring biodiversity at the global level to help key decision-makers to evaluate the full economic, social, and environmental potential of biological resources.

12. Organisms from marine environments, both temperate and tropical, are probably the least known of all. Until relatively recently, for example, the deep sea was believed to be without life. Today it is known that it possesses

an abundance of biological resources with more than 800 known species. Ocean hydrothermal vents, such as the sulfide chimneys called "black smokers", contain at least 16 new families of invertebrates that were unknown five years ago. Also recently, an entirely new set of organisms called "picoplankton" were discovered. The productivity of marine systems may have been underestimated by one-half due to ignorance of the role played by this picoplankton and the lack of appropriate methods of measurement. 3/

13. Even where data or genetic materials are collected for scientific purposes, they are all too frequently incomplete or badly managed. For example, there are currently about 3.3 million seed samples of species and their wild relatives in about 750 genebanks around the world. 4/ However, many are poorly equipped, managed and maintained, and some do not follow established genebank standards. Lack of adequate financing is an important problem for genebanks, as well as a symptom that the problem of conservation is not adequately addressed at the societal level. As a result, it is possible that as much biodiversity is being lost in these genebanks as in the field. Some collections have already been lost completely and many of the most important collections of crops are stored under conditions inadequate to ensure their long-term survival or full usefulness.

14. In the wild, the loss of tropical forests is not only reducing the populations of many species very significantly. It is estimated that reducing the size of a habitat by 90 per cent will reduce the number of species which it can be support by about 50 per cent in the long run. 5/ Species richness tends to increase from the poles to the equator and some parts of the planet are more important than others for maintaining the genetic diversity of crops. The loss of biodiversity can therefore have far-reaching implications even before scientists discover how ecosystems function. However, because no systematic comprehensive global monitoring system is in place and much of the necessary baseline information is not known, it is extremely difficult to estimate future - or even current - rates of loss.

15. A number of monitoring systems are in place or are planned. For example, under its GEMS programme, UNEP provides support to the World Conservation Monitoring Centre in its effort to monitor threatened and endangered species. IUBS/SCOPE/ and MAB/UNESCO, in collaboration with UNEP and the International Geosphere/Biosphere Programme are currently in the process of developing a global system for the study and monitoring of biodiversity and the role of ecosystem function. FAO and IBPGR are also currently in the process of developing a Global Information System and Early Warning System on Plant and Animal Genetic Resources to provide information and a practical inventory of genetic resources (both in situ and ex situ) and on the potential hazards threatening global extinction of species and breeds, with a periodical report on the state of the World's Plant Genetic Resources.

16. The FAO Global Animal Genetic Data Bank at Hanover already provides information on the world's livestock breeds. In addition, FAO is in the process of establishing an international network of ex situ base collections of biological resources, and has embarked on developing a network of in situ conservation areas. A global system for the security of the world's plant genetic resources is also beginning to take shape, but the existing

institutional capacity, structures and programmes are generally inadequate and under-funded. Current gaps and weaknesses need to be remedied if the system is to cope with the urgency of the situation.

17. Based on current systems and on traditional taxonomic approaches, it is likely to take several centuries to complete a comprehensive global survey of biodiversity. Efforts therefore need to be made to obtain an accurate assessment of the world's biodiversity prior to the completion of a more careful study. A truly comprehensive global system needs to be established, building on existing programmes, to enable changes in the distribution and state of biodiversity. This implies that there should be a global network of observation sites where work can be undertaken in a coordinated and cooperative manner, taking account of the significant differences between ex situ and in situ approaches.

CURRENT STATUS OF PROTECTION AND CONSERVATION

18. Protected areas probably provide the best mechanism so far devised for conserving biodiversity. To date, more than 130 nations have together established some 6,900 major, legally protected areas, covering almost five per cent of the planet's land surface (roughly twice the size of India). Since 1972, the total number of protected areas has almost doubled and the area protected has increased by over 60 per cent, with an even distribution over the different categories of protected areas. 6/ However, it appears that the rate of increase has begun to slow, and the options for additional protected areas - especially in the more strictly protected categories - seem to be closing in the face of competition from other forms of land use. This is frequently a result of population pressures and unsustainable development, with the five per cent looking less and less adequate.

19. Moreover, the level of legal protection for the 6,900 areas - and the enforcement mechanisms available to support protection - can vary significantly. As development has accelerated in recent decades, the growing importance of legally-protected areas as part of the overall pattern of land use has increasingly been recognized, as well as being the primary means for conserving the full range of wild biodiversity. Such sites maintain the essential ecological processes that depend on natural ecosystems. They also preserve the diversity of species and the genetic variation within them, as well as maintaining the productive capacities of ecosystems, safeguarding habitats critical for the sustainable use of biological resources, protecting landscapes and wildlife, providing opportunities for scientific research, education, training, recreation, and tourism, and serving as sources of national pride and human inspiration. All too frequently, however, in situ conservation efforts are perceived by local communities as a threat to their economic survival. Difficulties can also arise with government agencies, through inadequate management, uncertain and insufficient funding, and weak national constituencies.

20. Nevertheless, the value of protected areas seems likely to increase in the future. They make important contributions to maintaining the genetic raw materials for use in biotechnology, are likely to be central in programmes designed to adapt to changes in climate, and to the sustainable forms of

forestry envisaged in discussions about a possible new international consensus on forests. They also contribute to the development of ecologically sustainable fisheries and agriculture. However, recent advances in conservation have demonstrated that by themselves the strictly-protected categories will not be able to conserve all, or even most, biological resources and ecological processes. One possible response to this dilemma might be to design regional institutions and processes for large watersheds or bio-regions which cut across territorial and sectoral jurisdictions. They ought to be collaborative and participatory, translate sustainability into practical objectives, and take socio-economic as well as environmental factors into account. Such ecoregions, incorporating different categories of protected areas, agriculture, forestry, grazing, research, and education, would be managed so as to maintain the optimum levels of biodiversity.

BIOLOGICAL RESOURCES FOR MEETING HUMAN DEVELOPMENT NEEDS

21. Wild species and the genetic variations within them have an enormous potential for meeting human needs. One of the great achievements of humankind has been the harmonious exploitation of plant and animal resources through agriculture, forestry and fishery activities. Since the dawn of agriculture some 10,000 years ago, crops have been developed, modified and adapted to a wide range of new environments. The original diversity allowed some crops to spread globally and to adapt to environments very different from their original habitats. Rice is now farmed from sea level to high altitudes and wheat is grown in climatic conditions ranging from hot dry plains to humid and cool regions.

22. Traditional farming techniques tend to preserve biodiversity. Traditional Andean farmers in Bolivia may plant more than 30 different potato varieties in their fields. Some are drought resistant, other are especially adapted to wet periods. Some are good for eating fresh and others keep very well. This way farmers are excellent breeders, and they constantly improve their crops, developing new varieties, and dropping others, as circumstances warrant, but always keeping a large stock. By using traditional breeding methods, insights derived from genetics, and plant physiology, modern plant breeders have been able to increase the rate of production of new crop varieties, and increase dramatically their yields.

23. Some striking results have been obtained. China increased rice production substantially by developing hybrid rice using a male sterile strain collected from Hainan Island. Access to a wide range of genetic variability enhanced the capacity of plant breeders for developing new strains possessing a combination of desirable characteristics. These new varieties helped to keep food production above the rate of population growth in most parts of the world, as well as to halt the conversion of more forested land to cropland. Farmers in India, for example, over the period 1965 to 1990, saw a 360 per cent increase in wheat yield with only a 65 percent increase in cropland. 7/ Much more could be expected if some material existing in genebanks could be returned to farmers through extension services and after sanitation. Hybrid rigor could also be exploited in more crops than presently done; technical knowledge and genetic stocks exist to exploit it. Many

genebanks have material on which studies indicate that they can provide within a very short time solutions to stop soil erosion and degradation, as well as alternatives to many contaminants and losses of biodiversity.

24. Mechanization, fertilizers, irrigation and chemical control of pests and diseases have reduced the need to utilize genetic variability. Modern plant varieties became increasingly uniform and spread over ever-larger geographical areas because of their tolerance to day length and temperature. In the process, biodiversity has been reduced. Emphasis needs to be placed on raising yield potential and more efficient use of inputs.

25. The challenge now is to reconcile the short-term imperative of increased food production with the long-term imperative to conserve genetic resources to sustain future food supplies. The Stockholm Conference on the Human Environment in 1972 underlined the critical significance of plant and animal genetic resources to global food security, as well as to the security of the livelihoods of million of rural families. The urgency of the challenge has now increased significantly. The ability of agriculture to respond to this need might depend heavily on actions taken now to preserve its inheritance of biodiversity.

26. The economic value of the contribution made by biological and genetic resources to agriculture, pharmacology and industry amounts to many billions of dollars per annum. One study, for example, estimated that about 4.5 per cent of GDP in the USA is attributable to the harvest of wild species, amounting to an average of $US 87 billion per year in the late 1970s. 8/ Information is also gradually accumulating on the economic benefits to be derived from using biodiversity in the form of genetic resources to improve crop production and animal husbandry by conventional breeding. In 1983, FAO established the Global System for the Conservation and Utilization of Plant Genetic Resources (PGR), which includes a non-binding legal framework (the International Undertaking on PGR) and an Intergovernmental forum (the Commission on PGR). To date, 128 countries are formally part of the Global System. The Commission has recognized the rights of the countries which provide their genetic diversity to be compensated through the concept of farmers' rights. This concept will be given practical meaning through an international funding mechanism to support a global plan of action to be developed during the IV International Technical Conference on PGR to be hosted by FAO in 1993. The Commission has also developed an International Code of Conduct for the collection and transfer of plant genetic resources.

27. The economic and other values of biological resources are nevertheless all too frequently poorly defined. They are frequently underestimated because only short-term commercial market values are taken into account. While it is difficult to quantify some aspects of the value of biodiversity, much can nevertheless be done to assess the value of commercially-harvested products such as timber, fish, and medicinal plants. Field research can also be used to ascribe values to natural products such as game meat and non-timber forest products which are consumed directly, often without passing through the marketplace. The indirect values of ecosystem functions, such as watershed protection, tourism, soil conservation and climate regulation are harder to quantify, but approximate estimates can be made and they will certainly be more accurate than current de facto values (i.e. zero, in most cases).

28. Tourism, one of the world's largest industries in terms of revenue generated is often based on biodiversity, especially on exotic plants and animals. Such nature-based tourism can bring numerous socio-economic benefits to a country, in terms of creating local employment, stimulating local economies, generating foreign exchange, stimulating improvements to local transportation infrastructure, and creating recreational facilities. Positive effects on the environment are often derived from these socio-economic benefits. Appropriate management structures, as well as adequate physical infrastructure and facilities, for tourists are however required to ensure that tourism enhances rather than detracts from biodiversity, and that carrying capacity for tourists is assessed relative to the management objectives to the area. In many parts of the world, the conflict between conservation objectives and the needs of local people increasingly involves tourism as well. How to ensure that local communities earn an appropriate share of the profits from tourism is already a major issue.

29. Local communities may benefit from conservation measures when appropriate investments are made in managing the resources at sustainable levels. For example, the exploitation of forests for timber and other forest products, using appropriate techniques, can be done without endangering the integrity of the ecosystem. While plantations will provide an increasing proportion of the world's timber needs, harvesting from naturally growing forests will continue, as they are still an important social and economic force in many countries. If properly managed, such forests can also make an important contribution to conserving biodiversity. FAO, IUCN, MAB/UNESCO and others have prepared guidelines on sustainable forestry promoting the conservation of biodiversity which invariably involve leaving some forested areas as sources of seeds and other genetic material. Managing primary forests together with protected areas can lead to benefits for both forestry and local people (See Forest document A/Conf.151/PC/64).

30. Many critical habitats in the coastal zone also need protection. In addition to shoreline protection and sustainable harvesting of construction materials, such areas can be especially important as fish breeding grounds (particularly when the surrounding waters are over-fished). Virtually all wetland habitats are important not only for migratory birds, but also for conserving the biodiversity of fisheries, and protecting inland floodplains which are often affected by development projects. Some natural areas, notably wetlands near urban centers, are effective natural sewage treatment centers. For example, Calcutta's sewage has been naturally purified in the 4,000 hectare "Salt Lakes" marshlands east of the city for over 50 years, providing employment for 20,000 fishermen and reducing coliform bacteria levels very significantly. The Salt Lakes therefore make an extremely important economic contribution to the people of Calcutta, and similar functions are served by numerous wetlands through the world. Investing in the maintenance of such systems can often make more economic sense than developing expensive new sewage treatment plants.

31. In industrialized countries the retail value of plant-derived drugs was estimated at $US 43 billion in 1985. It is estimated that the market in developed countries could reach $US 47 million by the year 2000, and this is with only 10 per cent of all plant species examined for their potential medicinal value. 9/ 10/. Today, with advances in plant biotechnology and the availability of new and accurate screening tools, interest in plants, and animals, as a source of raw materials for developing new medicinal products is expanding. The wide diversity of biological resources has made possible the improvement of health through the advancement of the pharmaceutical industry. About 40 per cent of all prescription drugs in industrialized countries are derived from biological resources or synthesized based on chemical make-up of biological resources. Fubocurarine, which is used as a muscle-relaxant during surgery, is based on curare, a plant-derived substance which South American Indians have been using for many years as poison for their blowpipe darts. Didemnin, a drug used against a wide range of viruses, is derived from sea squirts. Additionally, more than 500 marine organisms yield chemicals with anti-cancer potential. 11/ The extinction of biological resources means the loss of a whole pharmacopoeia of unknown size and value to humankind.

32. Indigenous peoples have traditionally used ecological systems and the diversity within to meet their own needs. However their practices have been more compatible with diverse ecosystems and landscapes as they manage crops and animals as mixed systems, as opposed to monocultural practices. Also pest management is usually biological. Indigenous people also modify ecosystems through the widespread use of fire, as a way to return nutrients to the soil and provide more light to crops. Animal husbandry methods use land more efficiently as a wider variety of animals are let to forage over the same area of land.

33. Women and children play an important role in the conservation of biodiversity. They are characteristically the gender and the age group that tend to agricultural activities in most developing countries. Women harvest food, collect fodder, feed the animals, prepare the medicines from wild plants and animals, as well as playing an important part in passing information down to the children. The degradation of ecosystems and landscapes therefore has major impacts on women and children, particularly when they have to move over larger areas in search of food and firewood. In many cases, these distances can exceed 15 kilometers (10 miles) per day. 12/

34. New developments in biology are allowing geneticists to introduce genes into crops from totally unrelated organisms. This increases the palette available to the breeder. It also attaches potential value to genes of wild species which in the pat were not useful. Fermentation is a another example of a very old technology which has been used for centuries, being revolutionized by the new biological knowledge, and making use of a new range of biodiversity. These new industries have a strong stake in the conservation of biodiversity. For example, the science of seed storage is fast evolving, using techniques for the ultra-drying of seeds, which may allow seeds of many species to remain viable under minimal storage conditions for long periods. The maintenance of a wide array of biodiversity and a wide genetic base is therefore fundamental to the future of biotechnology and sustainable development.

35. Biotechnology can bring certain objectives within reach that would otherwise be difficult, impractical, or impossible to achieve. Recent advances in biotechnology make it possible not only to map biodiversity, but also to conserve the resources and even to modify them to withstand adverse conditions such as ecological and environmental changes. There is a great need to support biotechnology research and development, particularly in developing countries, to enhance their ability to adapt, develop, and apply the technology to the conservation of biological resources. Technology transfer is an important element in the process of acquisition of biotechnology by developing countries. Efforts should be made to devise strategies for international cooperation in increasing human resources development in biotechnology, including supporting existing centres such as the International Centre for Genetic Engineering and Biotechnology.

INTEGRATING BIODIVERSITY INTO POLICY-MAKING

36. For biological and genetic resources to be maintained, understood and utilized at sustainable levels and equitably, policies and investments concerning them need to be planned in operational terms. Appropriate biodiversity considerations need to be incorporated into development policies, planning procedures and project formulation so that they become a central feature of policy-making at all levels. The main mechanisms by which biodiversity considerations can be integrated into the development process include land use planning, marine and coastal zone planning, forest management plans, and environmental impact assessment. Planners and policy makers, central and local government supported by the local community, as well as from national or international organizations, have pivotal roles in incorporating goals and means for biodiversity conservation into their efforts.

37. At the international level, the most notable activities to address the misuse of biological and genetic resources relate to the current negotiations on a biodiversity convention, which build on a number of relevant agreements, conventions, and planning mechanisms that have been adopted during the past several decades. These include the FAO Commission on Plant Genetic Resources, the International Undertaking on Plant Genetic Resources, the Tropical Forestry Action Plan, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar), the Convention Concerning the Protection of the World Cultural and Natural Heritage, and the Convention on the Conservation of Migratory Species of Wild Animals. At the national level, governments are taking actions to end subsidies promoting the loss of valuable resources, reform policies that result in the misuse of resources, and to stimulate national technical capacity to increase local benefits from biodiversity and genetic resources.

38. All countries, however, face formidable obstacles in reforming policies because of the strong vested interest in maintaining the status quo held by sectors that benefit from the short-term exploitation of resources. Because of these obstacles, the few positive changes in resource management policies are as yet having little impact on overall trends. At the local level, communities are taking steps independently or with government support to secure the resources that they depend on locally for their livelihoods. Such

activities include establishing community seed-banks, forming organizations to promote the conservation of indigenous crops, participating actively in planning and policy dialogues within the country, and in some cases even actively defending resources necessary for their livelihoods.

39. Development and conservation of biodiversity must proceed together, as they enhance and strengthen each other. It is unrealistic to expect that no loss of biodiversity will occur. It is crucial that policies be developed and implemented with the full knowledge of the value of the biodiversity that is lost. Where policy-makers are well-informed on the full costs and benefits of different policy choices, it is more likely that biodiversity conservation will be incorporated as an objective. Where the wider public is informed of the consequences for biodiversity of alternative policy choices, it too can play a more active and informed role in influencing these choices.

40. Many existing development policies and incentives tend to be perverse or inadequate towards biodiversity, and planning procedures tend to fragment biodiversity by traditional sectors. Policies for the conservation and development require well-targeted information. Unfortunately, information about the characteristics and extent of species, genes and habitats is scarce and typically offered in a form which is of little use for planners and policy-makers, having been developed by scientists for scientific purposes. In addition, the ethical, cultural and market values of biological resources are little understood and are therefore undervalued. In recent years, the increasing tendency to privatize plant breeding linked to breeders' and patent rights in industrialized countries has highlighted the need for equity in the relative recognition and reward accorded to the formal and informal innovation systems.

41. All these problems clearly need to be tackled if the conservation of biodiversity can truly come to be regarded as one of the leading goals of international policy-making as well as national development, and as an investment opportunity, rather than as a burden.

KEY SCIENTIFIC AND TECHNICAL LINKAGES

42. Forests: Forests and woodlands, especially those in the moist and seasonal tropics and in some parts of the sub-tropics but also temperate arboreal forests, contain a wealth of species of actual or potential socio-economic importance at the global, national and local levels, including wild relatives of important crop species. Approximately 40 per cent of the total forested land area lies within the tropics, providing some of the most complex ecosystems in the world in terms of species composition and interactions, structural variability and biological and ecological functions. These forests are being lost at a rate of about 17 million hectares per year (an area half the size of Japan), often because of the extension of the cultivated area. This clearly poses a serious threat to ecological stability, to the sustainability of development, and to human development and welfare.

43. Climate Change: Biodiversity is likely to play a key role as the climate changes. When the environment changes as a result of climate or other physical alterations, organisms of low relevance in ecosystems often evolve

into major roles. An example is the evolution of mammals following the demise of the dinosaurs. The greater the existing biodiversity, the better the biota can adapt to new environmental circumstances. With the general level of uncertainty which surrounds the issue of climate change, it is important that a minimum level of biodiversity be maintained. Especially important is maintaining biodiversity in coastal areas within 60 kilometers of the coast, which will be particularly impacted if the sea level rises as a result of global warming. In these areas, where more than 60 per cent of the human population now live, biodiversity has been reduced very drastically through draining of wetlands, destruction of mangroves, and other coastal ecosystems. The loss of such biological resources affects not only the ecological integrity of coastal areas, but also the security of the coastal communities.

44. The way in which biological resources adapt to any change is also likely to provide critical indicator information about the kind of changes taking place. More information is needed on which genetic resources are likely to be lost and needed as the climate changes, as well as on those parts of the planet in which food crops will be vulnerable to changes. It will also be necessary to monitor any changes in distribution patterns of species to ensure, for example, that protected areas are still in the most appropriate places. Furthermore, little information exists about climatic factors within natural areas of vegetation or crop systems. For these reasons and more, it will be important that biodiversity concerns are accorded the most careful consideration in the intergovernmental negotiating process on a Climate Change Convention.

45. Biotechnology: One of the main problems associated with reforestation in Africa concerns the problems of unsuitable seedlings. The use of biotechnology to provide more suitable seedlings offers the promise of much more successful planting operations. Recent advances in biotechnology research and development are now being used to speed the development and use of germ plasm in modern crop varieties and to develop new varieties. Biotechnology therefore offers new possibilities for increasing the production of food, medicines, energy, specialized chemicals and other raw materials, and for improving environmental management. This reinforces the need to maintain the richest possible pool of genes. As the field of biotechnology develops, the scope of future germ plasm needs will be far greater than now. The high stake which the biotechnology industry holds in the conservation of biodiversity should not be under-estimated: the projected loss of diversity could seriously endanger the genetic base required for the continued improvement and maintenance of currently utilized species and deprive humankind of the potential to develop new ones.

46. Oceans: The oceans, including enclosed and semi-enclosed seas, like terrestrial systems, contain a rich diversity of biological and genetic resources. They provide the basis for fisheries, and offer great potential in the provision of pharmaceutical products and new food species. Coral reefs and other coastal ecosystems, where most species are located, are of particular importance for biodiversity, providing habitats for feeding, reproduction, shelter and nursery grounds for juvenile species. The coral reefs in particular are likely to serve as indicators of climate change, pointing up threats to other species. Marine biodiversity also plays a

valuable role in small island states, coastal states, and other economies in which fisheries provide an important economic basis. The application of appropriate marine biotechnologies has an important role to play here, ranging from the types of hooks and nets used to catch fish to the radar and satellite technology used to locate schools of fish and the development of techniques to promote sustainable fish yields, as well as to avoid killing non-target fish species and destroying marine ecosystems.

IN SITU AND EX SITU CONSERVATION

47. Ex situ conservation, i.e. the maintenance of living organisms outside their natural habitats, can be achieved by means of germ plasm banks (collections of seeds, tissues kept in vitro, etc.) and living collections (zoos, botanical gardens, arboreta, field genebanks, etc.). It has two unique attributes; it allows for the accumulation of knowledge on a particular group of individuals, and it permits immediate access. The first attribute helps make re-introduction possible and helps give a better cost estimate for particular biota. The second attribute is the basis of most plant introduction efforts in forestry, horticulture, etcetera. Germplasm introduction from ex situ facilities can be a tool for rapid agricultural progress. If wrongly used, it can be very harmful to native species (e.g. the introduction of the prickly pear in Australia).

48. In situ conservation concerns the maintenance of living organisms in the natural habitats and within the animal/plant community of which they form a part with little or no human intervention in the ways these organisms grow, reproduce and die. There is growing awareness that conservation of the earth's biota will be costly, whether by in situ or ex situ methods. It is important, therefore, that the most effective method or combination of methods should be chosen in each case and that experts in all aspects of conservation should work together in a fully integrated effort.

49. Ex situ methods can be considered a priority for the most endangered species. Once populations reach the point of extinction (e.g. the Californian condor or the Arabian oryx), ex situ methods may offer the only way to re-establish them. During the process of multiplication of species ex situ, very useful information can be obtained about the requirements for making successful future reintroductions into the wild. The reintroduction into China of the Père David Deer from the United Kingdom is only one successful example of this. Likewise, crop genebanks, having saved a particularly useful variety now extinct in the traditional agricultural system where it originated, can re-distribute it to breeders and farmers who require it.

50. Botanical gardens, herbaria, zoological museums, and marine stations, because of their high standards and long involvement in the study of species, play an invaluable role in the task of naming and classifying plants and animals and in the support of ex situ and in situ conservation. Their continued collaboration will be essential in biodiversity surveys; to document the resources of tropical and temperate regions, both terrestrial and aquatic; to document the resources of theses regions in terms of numbers of species and their distribution; to determine which species are most at risk; and to

indicate conservation priorities. These institutions maintain reference collections on which classification systems are based, which can now be used not only for naming but also for monitoring some aspects of genetic erosion.

51. New techniques allow extraction and typing of the DNA of dead specimens of organisms that are now extinct. It may be possible in the future to re-insert some of that DNA into living organisms. Museums also play an important role in public education and in training biologists and conservation specialists. The financial support however for museums, herbaria, botanical gardens, and marine biological stations has decreased recently, forcing them to reduce their technical and scientific staffs, and raising doubts about their ability to remain viable and assist in the study and conservation of biodiversity. The importance of their scientific and societal contributions have not been always recognized and a review of their resources is long overdue.

52. At the research level also, a much fuller integration between the different aspects of conservation seems appropriate. Periodic assessment of the speed of genetic erosion or loss of species, together with the status of knowledge about target species, and a careful assessment of resources available for conservation (both technical and social), are among the key elements for decision-making which are the common to ex situ and in situ conservation. Only by coordinating activities and sharing information can conservation scientists and managers develop the most appropriate and cost-effective strategies.

EDUCATION, TRAINING, AND KNOWLEDGE

53. There is a need for more education on the importance of biodiversity for human welfare, in training of specialized personnel, and in research to increase our knowledge about the role that biodiversity plays in the maintenance and evolution of species and ecosystems.

54. There is an acute lack of training opportunities. This problem is most acute in the developing countries. Over two-thirds of the world's biodiversity is located in developing countries, together with three quarters of the world's population, but only 6 per cent of the wor 's engineers and scientists. There is a great need therefore to build up the ability of many of these countries to train specialized personnel in order to expand their capacity to conserve their biodiversity and use their biological resources wisely.

55. Job opportunities in fields involved with the study, conservation, and management of biodiversity, are few and relatively poorly paid worldwide. Often trained personnel occupy positions which are not directly related to the study, conservation, or use of biological resources. The fundamental importance of biodiversity in the development process, and its role in ecosystem function, needs to be fully recognized at all levels of policy making. For this purpose, it is necessary that the resources be provided to create or strengthen institutions concerned with biodiversity.

56. There is a lack of specialists who can advance and pass on their knowledge of biodiversity, how it functions and how best to conserve it. The case of taxonomists is especially critical; everywhere, the number of taxonomists capable of identifying plants, animals and micro-organisms that make up the biodiversity of the planet has sharply dropped in recent years. Universities no longer teach taxonomy specialists and resources are lacking to create posts for them. Furthermore, the science of conservation biology, which emphasizes the genetic aspects, is as yet in its infancy and is rarely applied. Work in this field has indicated, for example, that most protected areas in the world are in fact too small to maintain a viable, adequately diverse population of their larger mammals, which means that they will not survive in these areas in the longer term. There is therefore a need to build up the numbers of specialists who can advance this knowledge and propose practical solutions.

57. Ex situ conservation efforts are also far too limited with inadequate numbers of trained personnel. Many zoos and botanical gardens for example do not yet participate in the global efforts for captive breeding or propagation of endangered wild species or the conservation of endemic species. Links with in situ conservation efforts are also inadequate. Furthermore there is a great need to increase the numbers of genebanks, especially in developing countries, as well as conservatories for maintaining stocks of varieties of agricultural plants and traditional breeds of livestock.

58. There are also insufficient trained personnel to document and pass down to future generations traditionally-acquired knowledge and skills for conserving and using resources. Such knowledge and skills have very often been based on centuries of trial and error and offer great potential for truly sustainable use. The situation is compounded by the fact that many traditional societies and indigenous cultures are rapidly disappearing, in both the north and the south. Biodiversity is inextricably linked to indigenous cultural values. Biodiversity depletion means cultural depletion and poverty. For many indigenous peoples the concept of poverty includes not only the lack of goods, services, and income, but also the loss of opportunities to relate with nature in its great diversity. In practical terms, an effort needs to be made to rescue not only the traditional knowledge which has been accumulated over the centuries, but the knowledge of farmers, ranchers, and non-professional naturalists all over the world.

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